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The genus *Peckoltia* with the description of two new species and a reanalysis of the phylogeny of the genera of the Hypostominae (Siluriformes: Loricariidae)

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Abstract

Peckoltia contains 12 described species, eight of which are considered valid. *Peckoltia arenaria, P. filicaudata,* and *P. ucayalensis* are recognized as synonyms of *P. bachi* and *P. kuhlmanni* is recognized as a synonym of *P. vittata*. In addition, two new species are described. The type species of *Peckoltichthys* and *Sophiancistrus* are synonyms of *P. bachi* and both genera are recognized as junior synonyms of *Peckoltia*. The species of *Peckoltia* range throughout much of the Amazon basin, the upper Orinoco, the upper Essequibo, and perhaps the Maroni, and can be identified from most other ancistrins by having dentaries that form angle of 90° or less and from others with angled dentaries by lacking the synapomorphies of those genera. The species of *Peckoltia* vary from one another mostly in coloration. *Peckoltia braueri, P. caenosa* n. sp., *P. cavatica* and *P. vittata* lack spots on the head while the other species have them. *Peckoltia braueri* and *P. cavatica* have orange bands in the dorsal and caudal fins and have the bones and plates of the head and nape outlined in black (vs. no orange bands and head plates and bones not outlined in black in *P. caenosa* and *P. vittata*). *Peckoltia caenosa* has a color pattern consisting of dark vermiculations on the head and abdomen (vs. saddles or blotches on the head and faint dark spots on the abdomen in *P. vittata*). Among the species with spots on the head, *P. lineola* n. sp. and *P. vermiculata* have some of the spots combining to form vermiculations (vs. spots free in *P. bachi, P. brevis, P. furcata,* and *P.*

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oligospila) with the vermiculations larger than the pupil in *P. lineola* and narrower in *P. vermiculata* and the vermiculations radiating from a central point in *P. vermiculata* vs. no such pattern in *P. lineola*. *Peckoltia bachi* can be identified from the other species by having widened pelvic-fin spines that can be pulled ventrally such that they are completely ventral and parallel to the body (vs. pelvic-fin spines narrow and cannot be adducted ventral to body) and by having the eye low on the head (vs. high). *Peckoltia brevis* can be identified from *P. furcata* and *P. oligospila* by having well-developed dorsal saddles (vs. saddles faint), no spots on the body behind the nape (vs. spots generally present behind the nape); from *P. oligospila* by having bands in the caudal fin (vs. spots); and from *P. furcata* by having the lower caudal-fin spine longer than the upper (vs. upper spine longer). *Peckoltia furcata* can be identified from *P. oligospila* by having the upper caudal-fin spine longer than the lower (vs. lower spine longer) and by having bands in the caudal fin (vs. spots). *Ancistrus yaravi* had been recognized as a species of *Peckoltia*. The type of *A. yaravi* is lost, but the original description suggests that the species is the senior synonym of *Neblinichthys roraima*. A revised morphological phylogeny demonstrates the lack of support for *Peckoltia* and *Hemiancistrus* as monophyletic, and phenetic definitions are provided for the two genera. The phylogeny also demonstrates a lack of support of the genus *Watawata*.

Key words: Ancistrini, *Hemiancistrus*, *Neblinichthys,* Neotropics, South America

Introduction

Peckoltia is a medium-sized genus of the loricariid catfish subfamily Hypostominae, tribe Ancistrini with 13 species currently recognized from the Orinoco, Amazon, and Essequibo River drainages (Fisch-Muller, 2003; Armbruster, 2004; Armbruster and Werneke, 2005). The name *Peckoltia* is often applied to a wide variety of fishes by scientists and aquarists, but the true *Peckoltia* are fairly rare in collections and are rarely exported for the pet trade. Most species that masquerade as *Peckoltia* are species of *Panaque* (*Panaqolus*) or *Hypancistrus*.

Currently, the state of the taxonomy of *Peckoltia* is confused. No diagnosis has been presented for *Peckoltia*, and the species placed in *Peckoltia* and the potentially related *Hemiancistrus* are in a state of disarray. In the original description of *Peckoltia*, Miranda Ribeiro (1912) did not designate a type species for the genus, although *Chaetostomus vittatus* Steindachner 1881 would be the type by monotypy, and later Gosline (1945) designated *Chaetostomus vittatus* as the type of *Peckoltia*. Ferraris (2007) states that Miranda Ribeiro had intended on publishing *Peckoltichthys* as a replacement name for *Peckoltia*, which was already a genus of plants. The publication of this paper was delayed (Miranda Ribeiro, 1920), and was preceded by the publication of *Peckoltichthys filicaudatus* as the sole species (and the type by monotypy) of *Peckoltichthys* (Miranda Ribeiro, 1917). Isbrücker (1980) recognized *Peckoltichthys* as an unnecessary emendation of *Peckoltia* and kept this arrangement later (Isbrücker, 2001); however, with each genus having a different type species, this is incorrect. Isbrücker *et al.* (2001) described *Sophiancistrus* (type *Hemiancistrus ucayalensis* Fowler 1940). *Peckoltichthys* and *Sophiancistrus* were recognized as synonyms of *Peckoltia* in Fisch-Muller (2003) and Armbruster (2004). Fisch-Muller (2003) also recognized *Ancistomus* as a synonym of *Peckoltia*, but Armbruster (2004) recognized it as a synonym of *Hemiancistrus*.

The species of *Peckoltia* and *Hemiancistrus* were found to be part of several clades (Armbruster, 2004). *Peckoltia ucayalensis* was sister to *Panaque*, and species similar to *Peckoltia vittata* were sister to this larger clade. *Peckoltia sabaji* and *Hemiancistrus* sp. (now described as *H. guahiborum*) were found to be in an unresolved polytomy at the base of the other species of *Peckoltia*, *Panaque*, *Hypancistrus*, and *Parancistrus*. Other species of *Hemiancistrus* were found to be members of *Pseudancistrus*, the Pterygoplichthini, and at the base of the Ancistrini. *Peckoltia* presents a very difficult and confusing taxonomic problem. In this paper, *Peckoltia* is restricted to those species similar to *P. vittata*, the type of the genus, a phenetic definition of *Peckoltia* is provided as the genus does not appear to be monophyletic, two new species of *Peckoltia* are described, *Peckoltichthys* and *Sophiancistrus* are recognized as junior synonyms of *Peckoltia*. *Peckoltia sabaji* is transferred to *Hemiancistrus* until such time as a proper diagnosis of *Hemiancistrus* can be made. *Ancistrus snethlageae* (placed in *Peckoltia* by Fisch Muller, 2003, and Ferraris, 2007, and in *Ancistomus*,

Isbrücker et al., 2001), was recognized in *Hemiancistrus* by Armbruster (2004), and is included in a revised and expanded phylogenetic analysis based on Armbruster (2004).

Methods

Methods follow Armbruster (2003a). Institutional abbreviations are as listed in Leviton *et al.* (1985) with the addition of UG/CSBD for the University of Guyana, Center for the Study of Biological Diversity. *Peckoltia braueri* and *P. cavatica* were recently described or redescribed (Armbruster and Werneke, 2005), and descriptions are not repeated here. *Peckoltia multispinis* is not included in species diagnoses and the key because the species is of dubious validity and I have only examined photographs of the recently rediscovered type (see *P. multispinis* description). Names of skeletal characteristics are as in Schaefer (1987) and of plate rows as in Schaefer (1997). The following abbreviations are used in the text: cs = cleared and stained, D. = distance, Dia. = diameter, Dp. = depth, dr. = drainage, L. = length, premax. = premaxillary, W = width. Cleared and stained specimens indicated in specimens examined lists are included in the number of specimens examined (4, 1 cs means that there are four specimens in total, one of which is cleared and stained).

The phylogenetic analysis follows Armbruster (2004), and a revised data matrix with new taxa and some minor revision of character states (Appendix 1). Revisions to Armbruster (2004) only involved some taxa changing states for a few characters and Character 103 was removed as it did not seem to be providing phylogenetic signal. Some taxa (particularly some *Hypostomus* and some *Pareiorhaphis*) were removed from Armbruster's (2004) dataset because they were part of large polytomies; however, data for these removed species are given in Appendix 1. The partially ordered matrix with *Scoloplax* excluded of Armbruster (2004) was used. Phylogenetic analysis was performed using PAUP*, version 4.0b4a, (Swofford, 2000) using 100 replicates of the tree bisection-recombination algorithm of the heuristic search. The ingroup included most genera of the Hypostominae and the Neoplecostominae, representative members of the Loricariinae and the Hypoptopomatinae, and *Astroblepus* and *Lithogenes*, and the outgroup included several callichthyids. One hundred bootstrap replicates were performed in PAUP* using a heuristic search (TBR) with one replicate and the maximum number of trees set at 15,000. Character state evolution was examined using MacClade, ver. 3.08a (Maddison and Maddison, 1999) on the first of the trees found (as in Armbruster, 2004) with only unambiguous characters resolved for those nodes in the strict consensus tree (Appendix 2). Bremer Decay support was estimated with TreeRot using 40 heuristic search (TBR) replicates per node with the maximum number of trees set at 1000.

Peckoltia Miranda Ribeiro (1912)

Peckoltia Miranda Ribeiro, 1912:7. Type species: *Chaetostomus vittatus* Steindachner, 1881.
Peckoltichthys Miranda Ribeiro 1917:49. Type species: *Peckoltichthys filicaudatus* Miranda Ribeiro, 1917.
Sophiancistrus Isbrücker & Seidel 2001 (in Isbrcker, et al., 2001):21. Type species: *Hemiancistrus ucayalensis* Fowler, 1940.

Species Included:

Hemiancistrus arenarius Eigenmann and Allen 1942 (synonym of *P. bachi*)
Chaetostomus bachi Boulenger 1898
Hemiancistrus braueri Eigenmann 1912
Hemiancistrus brevis La Monte, 1935
Peckoltia caenosa new species
Peckoltia cavatica Armbruster and Werneke 2005

Peckoltichthys filicaudatus Miranda Ribeiro1917 (synonym of *P. bachi*)
Chaetostomus furcatus Fowler 1940
Peckoltichthys kuhlmanni Miranda Ribeiro 1920 (synonym of *P. vittata*)
Peckoltia lineola new species
Ancistrus multispinis Holly 1929
Chaetostomus oligospilus Günther 1864
Hemiancistrus ucayalensis Fowler 1940 (synonym of *P. bachi*)
Chaetostomus vittatus Steindachner 1881 (type species of *Peckoltia*)
Chaetostomus vittatus vermiculata Steindachner 1908 (recognized as *Peckoltia vermiculata*)

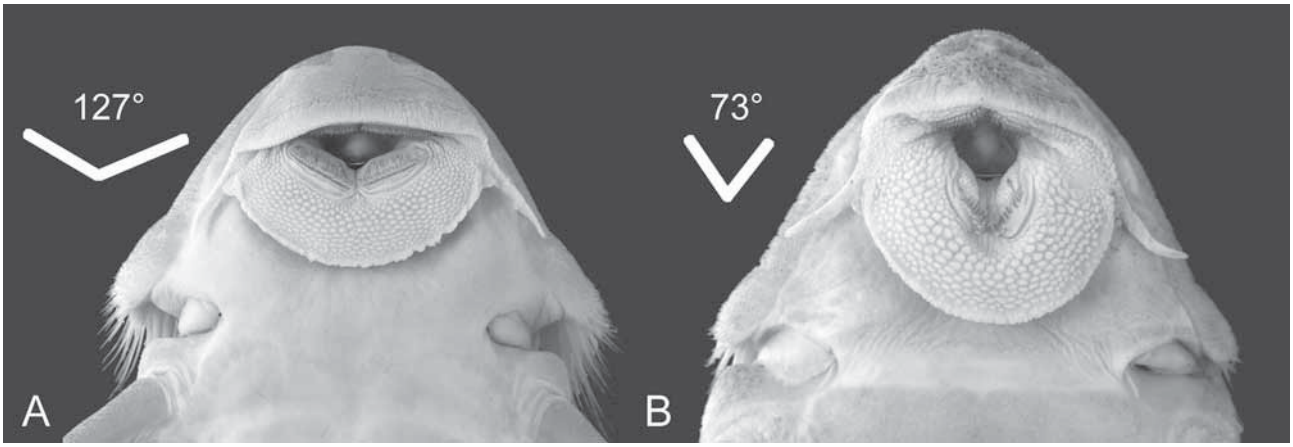

FIGURE 1. Ventral view of mouths of A. *Hemiancistrus snethlageae* MCP 15151, 132.8 mm SL, and B. *Peckoltia lineola*, MCNG 55684, holotype, 88.1 mm SL. Lines are representations of the orientations of the dentaries and the approximate angle for these fishes is provided.

Diagnosis: *Peckoltia* cannot be diagnosed by any synapomorphies and is likely a paraphyletic assemblage. In the phylogenetic analysis below, it was not monophyletic; however, there are no clues as to how *Peckoltia* should either be split or combined with other genera, support for nodes around the species of *Peckoltia* are weak, and *Peckoltia* is recognized through the set of comparisons that follow. *Peckoltia* can be diagnosed from all other loricariids except members of the Ancistrini and Pterygoplichthyini by having hypertrophied cheek odontodes on plates that can be everted greater than 75° from the head. *Peckoltia* can be identified from the Pterygoplichthyini by lacking a modified stomach (vs. having the stomach connected to the dorsal abdominal wall by a connective tissue sheet (see Armbruster, 1998b; 2004); from *Pterygoplichthys* by having seven dorsal-fin rays (vs. nine or more); and from the *Hemiancistrus annectens* group by having more than ten hypertrophied cheek odontodes in adults (vs. usually three or less although up to nine). *Peckoltia* can be identified from all other ancistrins except *Exastilithoxus, Hypancistrus, Leporacanthicus, Lithoxus, Megalancistrus*, *Panaque* and *Spectracanthicus* by having the dentaries forming angle of ~90° or less (Fig. 1); from *Exastilithoxus*, *Leporacanthicus,* and *Lithoxus* by having oval lips (vs. round lips), and by having a very deep body (vs. dorsoventrally flattened); from *Exastilithoxus* by lacking fimbriae along the lower lip; from *Leporacanthicus* by lacking fimbriae above the upper lip; from *Leporacanthicus, Megalancistrus,* and *Pseudacanthicus* by having three plates between the head and the dorsal fin (vs. four or more, nuchal plate is included), by lacking sharp keel odontodes, by having viliform (vs. stout) teeth; from *Hypancistrus* by having the teeth in the dentary and premaxilla of about equal size (vs. dentary teeth almost twice as long as premaxillary teeth); from *Panaque* by having viliform teeth (vs. spoon-shaped or elongate, spatulate teeth); from *Panaque* (*Panaqolus*) by always having at least a small buccal papilla (vs. buccal papilla absent); from *Spectracanthicus* by having the dorsal and adipose fins separate (vs. posterior membrane of the dorsal fin expanded such that it contacts at least the preadipose plate and usually the adipose-fin spine), by usually lacking odontodes

on the opercle as adults (vs. odontodes present), and by having a pattern of dorsal saddles (vs. either all dark or dark with white to yellow spots); and from *Spectracanthicus murinus* by having evertible cheek plates with hypertrophied odontodes.

Adult *Peckoltia* (except some *P. bachi*) have no odontodes on the opercle, a trait shared among the ancistrins with *Baryancistrus, Hemiancistrus, Hypancistrus, Panaque*, and *Parancistrus*. In addition to the shortened, angled jaws, *Peckoltia* can be identified from *Baryancistrus* and *Parancistrus* by having the posterior membrane of the dorsal fin short and the dorsal and adipose fins separate (vs. posterior membrane of the dorsal fin expanded such that it contacts at least the preadipose plate in all except *B. longipinnis*, where the membrane is only expanded); from *Baryancistrus, Hemiancistrus,* and *Parancistrus* by usually having a pattern of dorsal saddles with spots, if present, just on the head and ventral surface (vs. dark or light spots present behind the head and saddles absent; this works for all except *P. bachi, P. oligospila* and some *P. furcata*); and from *Parancistrus* by having restricted gill openings (vs. large gill openings), and having the body deep and narrow (vs. wide and dorsoventrally flattened). *Peckoltia oligospila* and *P. furcata* can be further separated from *Baryancistrus*, *H. chlorostictos, H. fuliginosus, H. guahiborum, H. macrops, H. meizospilos, H. subviridis, H. votouro,* and *Parancistrus* by having dark spots (vs. with light spots or uniformly dark); and from *H. medians* by lacking keels anterodorsally (vs. short keels present). *Peckoltia oligospila* can be identified from *H. punctulatus* and *H. megalopteryx* by having less than 25 teeth per jaw ramus (vs. 40 or more). *Peckoltia furcata* can be identified from *H. punctulatus* by having a strongly forked caudal fin (vs. caudal fin emarginate) and from *H. punctulatus* and *H. megalopteryx* by having bands in the caudal fin (vs. spots or uniformly dark).

Peckoltia bachi
(Figs. 2a and 3–4)

Hemiancistrus arenarius Eigenmann & Allen, 1942: 185, pl. 6 (fig. 2). Type locality: Yurimaguas. Holotype: CAS 77323.

Chaetostomus bachi Boulenger, 1898: 425, pl. 41 (fig. 1). Type locality: Rio Jurua, an affluent of the Amazons, Brazil. Holotype: BMNH 1897.12.1.61.

Peckoltichthys filicaudatus Miranda Ribeiro, 1917: 49. Type locality: Fluvio Solimes [Brazil]. Holotype: MNRJ 969.

Hemiancistrus ucayalensis Fowler, 1940: 235, figs. 24–25. Type locality: Ucayali River, Contamana, Peru. Holotype: ANSP 68651.

Material examined: All collections Río Amazonas drainage (except ICNMNH 7955): BRAZIL, Unknown state: BMNH 1897.12.1.61, Holotype, 1, 95.0, Rio Juruá; MNHN A-1968, 1, 78.2, Río Amazonas, col. by Jobert; MNRJ 969, Holotype of *Peckoltia filicaudata*, 1, 97.6, Rio Solimões, col. by Alt. Machado da Silva. BRAZIL, Acre: MCP 35511, 1, Riozinho do Rola, tributary to Rio Acre, itself a tributary to Rio Purus, Rio Branco, 10°02’50”S, 068°18’39”W, L. Juno, 22–23 June 2003; MZUSP 50506, 1, Foz do Caipora, Rio Juruá, Coleção Reserva Extrativista Alto Juruá, 19 July 1994; MZUSP 50507, 1, Foz do Tejo, Rio Juruá, Coleção Reserva Extrativista Alto Juruá, 15 July 1994. BRAZIL, Amazonas: MCP 33228, 1, 93.8, Praia Caborini, confluence with Rios Solimões and Japurá, 03°09’34”S, 064°46’35”, col. by W. Crampton, 12 February 2001; MZUSP 24611, 1, Rio Purus, Açaituba, col. by P.E. Vanzolini, 26 December 1974; MZUSP 56113, 1, Rio Solimões, 29.6 km below the Juruá, 02°35’55”S, 065°30’57”W, col. by J.P. Sullivan *et al.*, 5 November 1993; MZUSP 56282, 1, Rio Juruá, 10.2 km below Lago Pauapixuna, 02°41’07”S, 065°48’27”W, col. by J.P. Sullivan *et al.*, 7 November 1993; MZUSP 57950, 1, Rio Purus, 13 km below Lago do Estopa, col. by Langeani *et al.*, 27 July 1996; MZUSP 74235, 1, Beach of Rio Solimões, at Ilha Muratu, in front of the mouth of Lago Januacá, col. by Alpha Helix Expedition, 6–25 January 1977.

COLOMBIA, Amazonas: ICNMNH 2584, Grammalote, L.F. Jimenez, July 1992; ICNMNH 9101, Puerto Nariño, Laguna Loreto Yacu, P. Cala, January 1972. COLOMBIA, Meta, ICNMNH 7955, Río Meta – Río Orinoco Drainage, Quebrada La Quinchalera, Rio Upia basin, San Luis de Gacero. COLOMBIA, Putumayo,

Puerto Leguizamo, Río Caquetá basin, collected by Proyecto Ornamentales del Amazonas, October 2005.

ECUADOR, Napo: FMNH 103265, 1, 92.4, Rio Napo at Destacamento Tiputini, 00°47'S, 075°33'00"W, col. by D. Stewart, M. Ibarra, and R. Barriga, 28 October 1981; FMNH 103266, 1, 85.7, Rio Aguarico at Destacamento Zancudo and mouth of quebrada Zancudococha, Río Napo Basin, 00°33'S, 075°30'W, col. by D. Stewart, M. Ibarra, and R. Barriga, 26 October 1983.

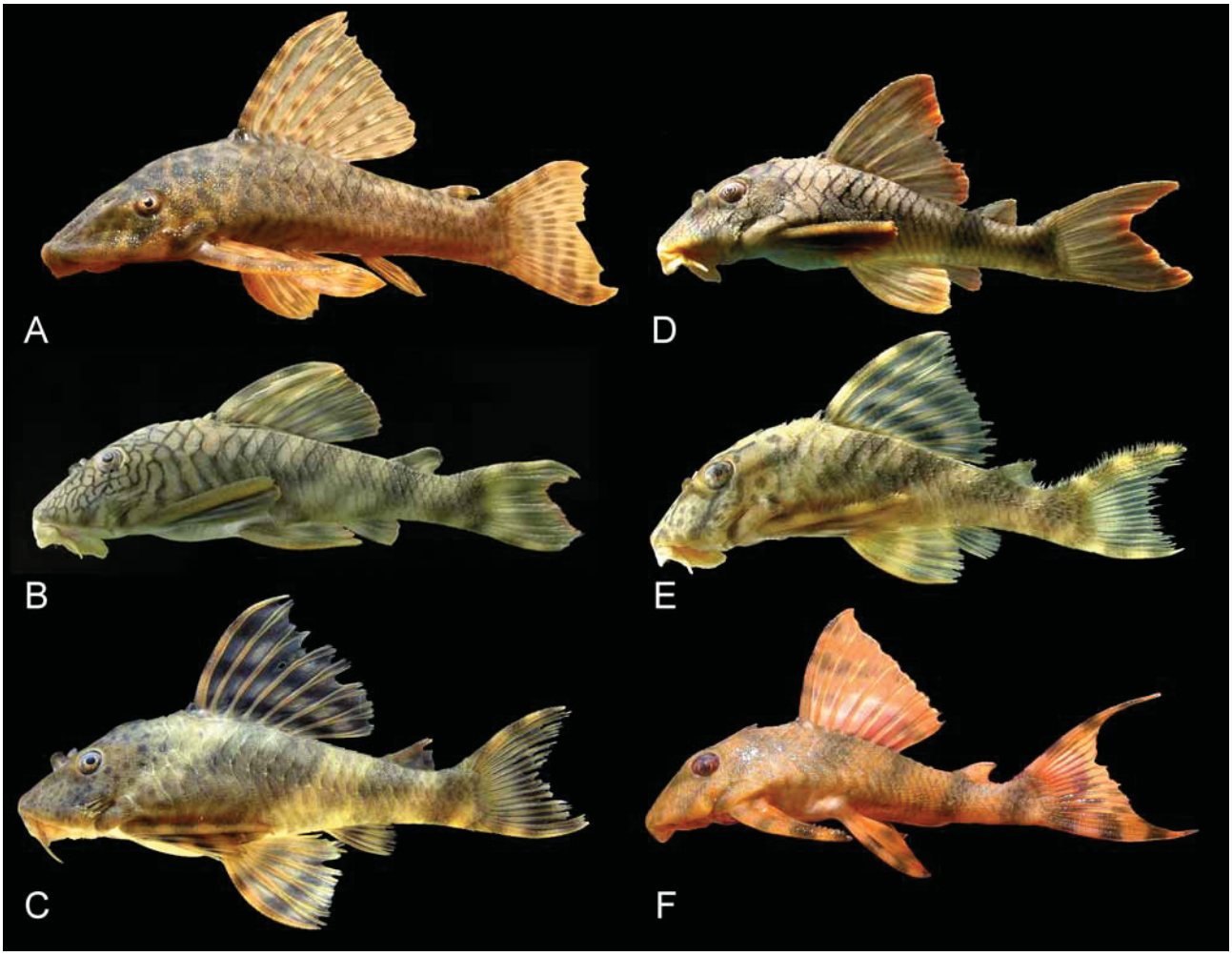

FIGURE 2. Live pictures of A. *Peckoltia bachi*, AUM 45592, B. *Peckoltia braueri*, AUM 38882, C. *Peckoltia brevis*, D. *Peckoltia cavatica*, UG/CSBD 11043, holotype, E. *Peckoltia lineola*, paratype, F. *Peckoltia vittata*, AUM 39313. Photographs by N.K. Lujan (A) and M.H. Sabaj (B-F).

PERU, Amazonas: ANSP 68652, Paratypes of *Peckoltia ucayalensis*, 2, Río Ucayali basin near Contamana, col. by W.C. Morrow, July 1937; LACM 36318–2, 3, 1 cs, 82.5–98.3, La Poza, stream 1 km N, Río Marañon basin, col. by T. Justice, 12 October 1979; LACM 36325–1, 4, 1 cs, 89.7–100.6, La Poza. stream 1 km N, Río Marañon basin, col. by T. Justice, 18 October 1979; LACM 41906–3, 1, 93.2, Caterpiza, Río Marañon basin, col. by M.P. Achamposh, 25 July 1979. PERU, Loreto: AUM 29578, 1, 81.2, Caño Saccarita, probably ca. 35 min. upstream by boat from the mouth of Tonche Caño, 03°36’50”S, 072°10’55”W, col. by D.M. Schleser, 1 June 1999; CAS 77323, Holotype of *P. arenaria*, and CAS 77324, Paratype of *P. arenaria*, Río Huallaga, Yurimaguas, col. by W.R. Allen, November 1920; Río Huallaga, Yurimaguas, col. by W.R. Allen, November 1920; CAS 77325, Paratype of *P. arenaria*, Río Alto Marañon below Pastaza, col. by W.R. Allen, October 1920; CAS 77326, Paratype of *P. arenaria*, Río Amazonas, Iquitos, col. by W.R. Allen, September 1920; INHS 39970, 1, 108.4, Río Itaya ca. 4–5 km upstream from Iquitos (Belém), above mouth of Quebrada Mazana, 03°47’71”S, 073°17’29”W, col. by B.M. Burr, M.H. Sabaj, J.W. Armbruster, M. Hardman, R.L. Powell, and R.E. Weitzell, 8 August 1996; INHS 40010, 1, 72.0, Caño Zapatilla ca. 10 min. upstream by

boat from Río Orosa, 76.4 mi E Iquitos, 03°32’47”S, 072°09’22”W, col. by M.H. Sabaj, J.W. Armbruster, M. Hardman, and F. Rios Tuluvea, 14 August 1996; INHS 44127, 1, 69.1, Río Napo and creek at Mazan, 33.3 km NE Iquitos, 03°29’33”S, 073°05’12”W, col. by M.H. Sabaj, J.W. Armbruster, M.W. Littman, 2 August 1997; SIUC 29317, 1, 98.5, Río Napo at Mazan, 33.3 km NE Iquitos, 03°29’33”S, 73°05’12”W, col. by M.W. Littman, M.H. Sabaj, and J.W. Armbruster, 1 August 1997; MNRJ 3962, 1, 77.3, Río Ampiyacu near Pebas, col. by W. G. Scherer, 28 February 1940; MNRJ 3963, 1, 77.3, Río Ampiyacú near Pebas, col. by W.G. Scherer; USNM 124885, 1, 104.6, Río Ampiyacu, col. by W. G. Scherer; USNM 329590, 1, 67.2, Maynas Province, Arcadia, Río Napo, quebrada Isla, col. by F. Chang *et al.*, 3 November 1993.

AQUARIUM SPECIMEN: INHS 40916, 1 cs (not measured).

Diagnosis: *Peckoltia bachi* is diagnosed by one unique characteristic: presence of deep pockets ventrally on the pelvic girdle for the insertion of hypertrophied pelvic adductor muscles. In whole specimens, this results in the ability to fold the pelvic fins ventrally such that the pelvic-fin spines run parallel with the ventral surface body. In addition, *P. bachi* can be diagnosed by the homoplasic characteristic of the presence of widened pelvic-fin spines.

Peckoltia bachi can be identified from all other *Peckoltia* by the presence of widened pelvic-fin spines, enlarged plates on the abdomen (Fig. 4), eye low on the head (Fig. 3–4), and opercle generally with a patch of odontodes at all ages (vs. opercle maximally with a single row of odontodes with odontodes disappearing with size). *Peckoltia bachi* can be identified from all other *Peckoltia* except *P. caenosa* by being mottled (vs. the presence of dorsal saddles or spots), and it can be identified from *P. caenosa* by having diffuse, large spots on the head and the abdomen without markings (vs. head and abdomen with vermiculations).

Description: Morphometrics in Table 1, counts based on 30 individuals unless otherwise stated. Largest specimen examined 108.4 mm SL. Body stout and fairly wide. Head and nape gently sloped to insertion of dorsal fin. Parieto-supraoccipital with slight rounded crest. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then inclined steeply to caudal fin. Ventral profile flat to caudal fin. Supraorbital ridge rounded, continuing to anterolateral corner of anterior nare. Mesethmoid raised slightly above lateral surface of snout to form slight ridge. Head contours smooth. Eye relatively large, set low on head. Interorbital space slightly convex; supraorbital ridge just slightly higher than interorbital space.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form very slight ridges that converge at adipose fin, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen almost completely plated with fairly large platelets; fairly large naked area around insertion of pelvic fins. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 23–27 (mode 24) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle usually supporting odontodes although some specimens lack odontodes on opercle. Posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 11–44, longest reaching anterior border of compound pterotic. Cheek plates evertible to approximately 90° from head.

Odontodes on tip of pectoral-fin spine slightly hypertrophied. Dorsal fin reaching preadipose plate when adpressed in some specimens; dorsal-fin spine not elongate. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and moderately long spine. Caudal fin emarginate, lower lobe longer than upper, I,14,I (one specimen I,13,I and one specimen with caudal peduncle damage I,17,I) with three to six (N=29, mode four) dorsal procurrent caudal-fin rays and three to six (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and approximately same length of first branched ray. Anal fin I,4. Pectoral-fin spine reaching slightly behind posterior insertion of pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6 (one specimen I,5). Pelvic fin reaching to middle of anal-fin when adpressed. Pelvic fin I,5.

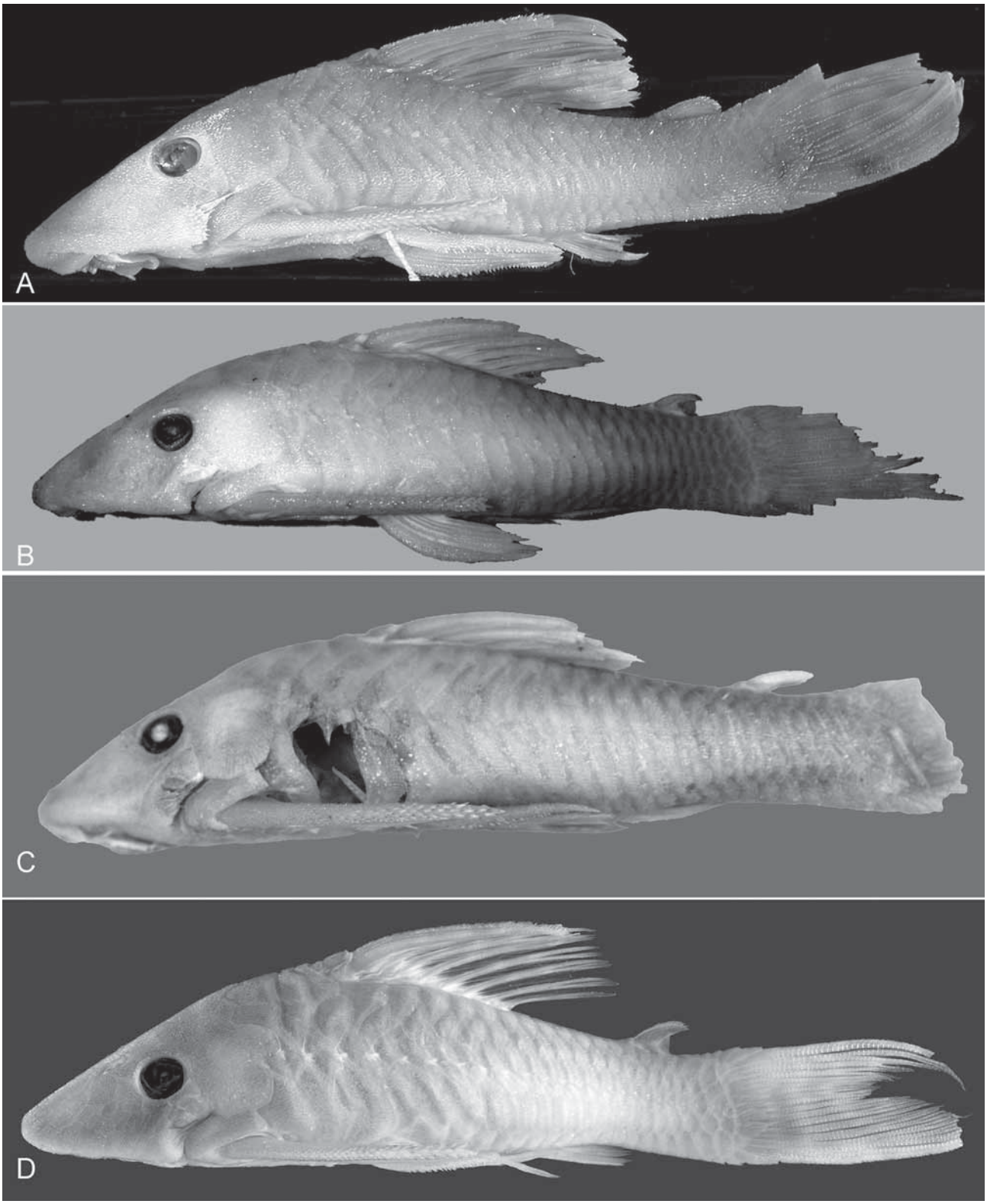

FIGURE 3. Lateral views of types of species assigned to *Peckoltia bachi*, A. *Hemiancistrus arenarius*, CAS 77323, holotype, ~80 mm SL; B. *Chaetostomus bachi,* BMNH 1897.12.1.61, holotype, C. *Peckoltichthys filicaudatus*, MNRJ 969, holotype, 97.6 mm SL; and D. *Peckoltia ucayalensis* ANSP 68652, 85.2 mm SL. Photographs by the California Academy of Sciences Department of Ichthyology (A) and J.W. Armbruster (B-D).

TABLE 1. Selected morphometrics of *Peckoltia bachi* and *P. braueri*. Numbers in parentheses refer to landmark numbers in Armbruster (2003). Measurements are ratios of SL (predorsal l. to pelvic-dorsal l.) or head l. (head-eye l. to premaxillary tooth cup l.).

	P. bachi					*P. braueri*				
	N	Avg.	SD	Min.	Max.	N	Avg.	SD	Min.	Max.
SL (1-20)	31	89.9	11.5	67.2	108.4	49	75.7	17	39.8	103.9
Predorsal L. (1-10)	31	43.9	1.2	41.7	46.9	49	43.0	1.2	40.1	46.9
Head L. (1-7)	31	35.2	1.5	33.4	40.6	49	36.9	1.4	35.0	41.5
Head-dorsal L. (7-10)	31	8.7	1.1	5.0	10.4	49	6.2	1.0	4.0	8.3
Cleithral W. (8-9)	31	31.3	1.1	27.9	33.0	49	31.2	1.4	28.5	38.1
Head-pectoral L. (1-12)	31	29.7	1.4	24.6	31.8	49	26.4	1.7	24.0	31.1
Thorax L. (12-13)	31	20.9	1.8	18.1	28.7	49	24.5	1.9	20.3	29.7
Pectoral-spine L. (12-29)	30	32.7	1.8	29.4	36.7	49	32.4	1.6	28.8	35.6
Abdominal L. (13-14)	30	23.0	1.2	20.4	25.2	49	23.0	1.2	19.8	26.1
Pelvic-spine L. (13-30)	30	23.0	1.4	21.2	27.5	49	26.9	1.4	24.5	31.6
Postanal L. (14-15)	31	32.8	1.9	28.9	36.6	49	33.7	1.7	29.9	36.5
Anal-fin spine L. (14-31)	30	15.9	1.5	13.4	18.4	46	14.4	1.2	12.5	17.6
Dorsal-pectoral D. (10-12)	31	29.5	0.9	27.5	31.0	49	29.1	1.1	27.3	34.3
Dorsal spine L. (10-11)	23	36.3	2.2	29.4	39.4	48	34.4	2.0	30.2	38.6
Dorsal-pelvic D. (10-13)	31	25.6	1.5	23.1	29.2	49	25.4	1.6	21.3	28.7
Dorsal-fin base L. (10-16)	31	26.7	1.0	25.0	29.5	49	28.7	1.9	23.9	31.9
Dorsal-adipose D. (16-17)	31	18.4	2.2	12.4	21.9	49	14.8	1.6	11.0	19.3
Adipose-spine L. (17-18)	30	8.7	2.2	6.6	18.4	49	9.4	1.0	7.1	11.5
Adipose-up. caudal D. (17-19)	31	14.2	1.5	11.3	18.8	49	17.9	1.9	13.8	21.4
Caudal peduncle Dp. (15-19)	31	13.7	1.4	10.5	16.8	49	9.9	1.6	7.6	13.7
Adipose-low. caudal D. (15-17)	31	21.6	1.3	19.1	24.5	49	23.7	1.4	20.8	27.9
Adipose-anal D. (14-17)	31	21.7	1.5	18.6	25.0	49	19.3	1.7	14.4	21.9
Dorsal-anal D. (14-16)	31	17.6	1.1	13.3	19.2	49	16.8	1.0	14.3	19.0
Pelvic-dorsal D. (13-16)	31	26.9	2.0	23.0	30.8	49	26.5	1.9	21.5	28.9
Head-eye L. (5-7)	31	44.7	2.4	38.5	47.9	49	37.6	1.8	33.9	42.9
Orbit Dia. (4-5)	31	19.3	1.2	16.2	21.2	49	21.9	1.9	19.7	27.1
Snout L. (1-4)	31	61.7	2.3	53.9	64.5	49	58.5	2.5	49.8	62.9
Internares W. (2-3)	31	21.0	2.0	15.5	24.0	49	14.2	1.6	10.3	18.1
Interorbital W. (5-6)	31	60.8	6.0	51.5	71.0	49	47.5	3.8	38.7	53.7
Head Dp. (7-12)	31	72.3	2.8	66.9	76.0	49	70.9	1.9	66.3	75.9
Mouth L. (1-24)	30	50.2	2.9	44.1	56.3	49	48.2	2.7	40.9	52.9
Mouth W. (21-22)	30	42.4	2.6	38.0	48.2	49	47.7	3.9	37.5	53.8
Maxillary barbel L. (22-23)	30	11.2	1.9	6.8	15.2	49	16.2	2.0	9.5	20.8
Dentary tooth cup L. (25-26)	31	13.7	1.7	9.5	17.5	49	13.9	2.2	9.5	18.1
Premax. tooth cup L. (27-28)	31	12.5	1.4	9.6	15.5	49	13.8	2.3	5.7	16.5

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with medium-sized papillae anteriorly and smaller ones posteriorly. Maxillary barbel short, not reaching gill opening. Buccal papilla represented only by very small flap, never

absent. Jaws narrow, dentaries forming angle just slightly greater than 90°, premaxillaries forming very shallow arc with overall angle less than 135°. Teeth with small, moderately narrow cusps, lateral cusp approximately half-length of medial cusp, stalks of teeth long, dentary and premaxillary teeth about equal in length; 13–25 dentary teeth (mode 22) and 11–22 premaxillary teeth (mode 19).

FIGURE 4. Dorsal, lateral, and ventral views of *Peckoltia bachi*, SIUC 29317, 98.5 mm SL. Photographs by J.W. Armbruster.

Color: Base color tan with slightly darker markings on most specimens (one specimen examined with greater contrast). Head with large spots or mottling. Body mottled occasionally with four weak saddles. Dorsal-fin spines and rays with oblong spots; interradial membranes usually unmarked or with slightly darker

spots. Pectoral, pelvic, and anal fins with slightly darker spots on spines and rays or unmarked. Caudal fin with dark spots combining to form bands that are wider than the light interspaces; bands darker on lower lobe. Abdomen and lower surface of caudal peduncle slightly lighter than sides.

Sexual Dimorphism: One specimen (presumably male) examined with hypertrophied odontodes on sides of body and posterior part of head. Hypertrophied odontodes becoming larger posteriorly, but lacking on caudal- and adipose-fin spines. No apparent increase in size of pectoral-fin spine odontodes.

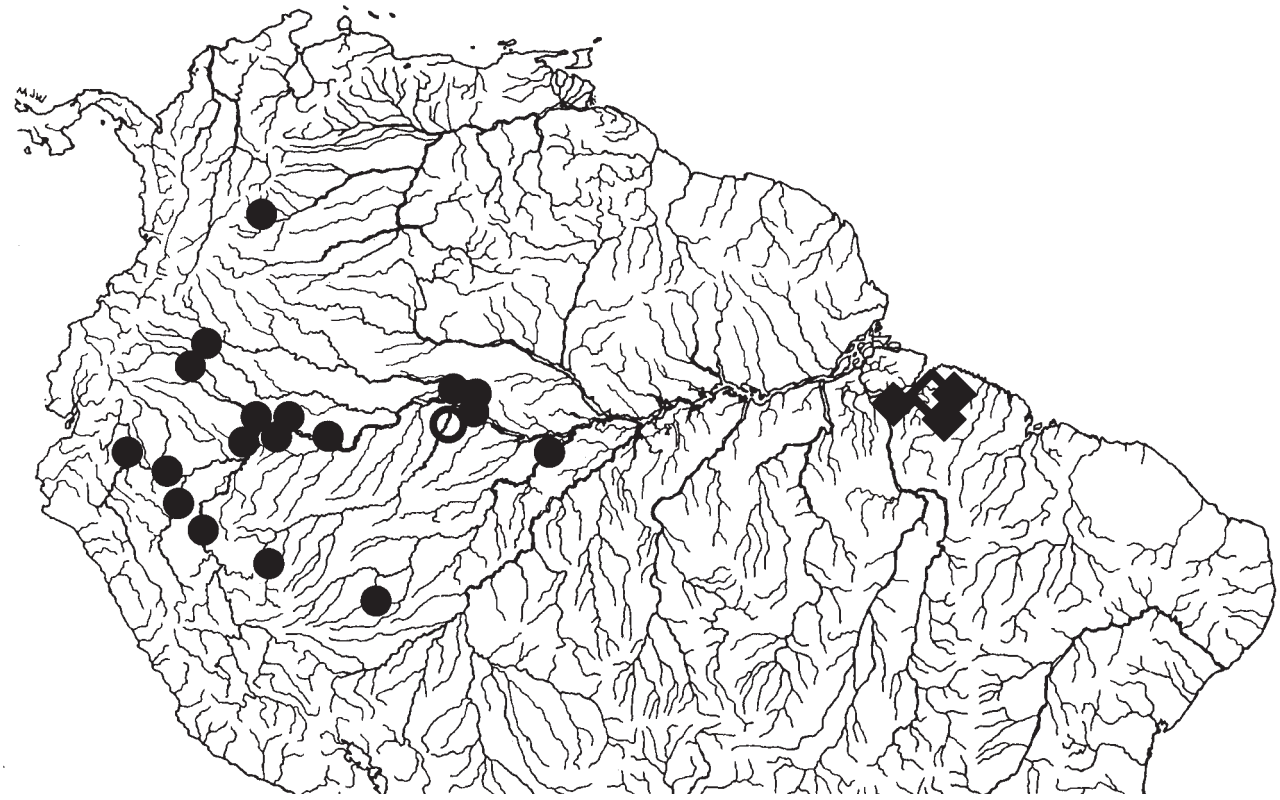

FIGURE 5. Distribution of *Peckoltia bachi* (circles) and *P. oligospila* (diamonds). Open symbols are type localities. Symbols may represent more than one locality.

Range: *Peckoltia bachi* can be found throughout the upper Amazon and its tributaries in Brazil, Colombia, Ecuador, and Peru (Fig. 5). One specimen was found from the Río Meta system near Villavicencio, Colombia. Given that no other specimens have been collected in the Orinoco basin, this collection is suspect. Villavicencio has been active in exporting fishes for a long time, and Armbruster (2005) suggested that a collection of *Lasiancistrus guacharote* (endemic to the Lago Maracaibo basin) collected near Villavicencio was the result of aquarium release. This may also be the case for *P. bachi*.

Habitat: *Peckoltia bachi* can be found at the edge of medium to large rivers among submerged twigs and grasses, usually in flow. The specimens I have collected appear to have been chased from the middle depths of submerged grasses and twigs as the seine was not fully on the bottom. This suggests that the hypertrophied pelvic muscles and widened pelvic-fin spines may be used to grasp the grasses and twigs. In morphology, *P. bachi* is very similar to *Hypoptopoma* of the Hypoptopomatinae, sharing the eye placed laterally on the head and the pelvic fins that can be adducted underneath the body. *Hypoptopoma* also will grasp submerged sticks with its pelvic-fins (pers. obs.).

Comments: There are some differences in intensity of pigmentation of specimens of *Peckoltia bachi*, but there is nothing to suggest that the species needs to be broken up. The types are all very similar, and nothing could be found to differentiate the various populations. Although the morphology of the species is quite different from any other hypostomine, the recognition of a separate genus for *P. bachi* at this time is without adequate justification. If it were to be recognized as a separate genus, it would be *Peckoltichthys*.

Peckoltia braueri
(Figs. 2b and 6–7)

Hemiancistrus braueri Eigenmann, 1912b: 232, pl. 28 (fig. 1). Type locality: Takutu, British Guiana. Holotype: ZMB 3174 (larger specimen).

FIGURE 6. Lateral view of holotype of *Hemiancistrus braueri*, ZMB 3174. Photo by M. Allen.

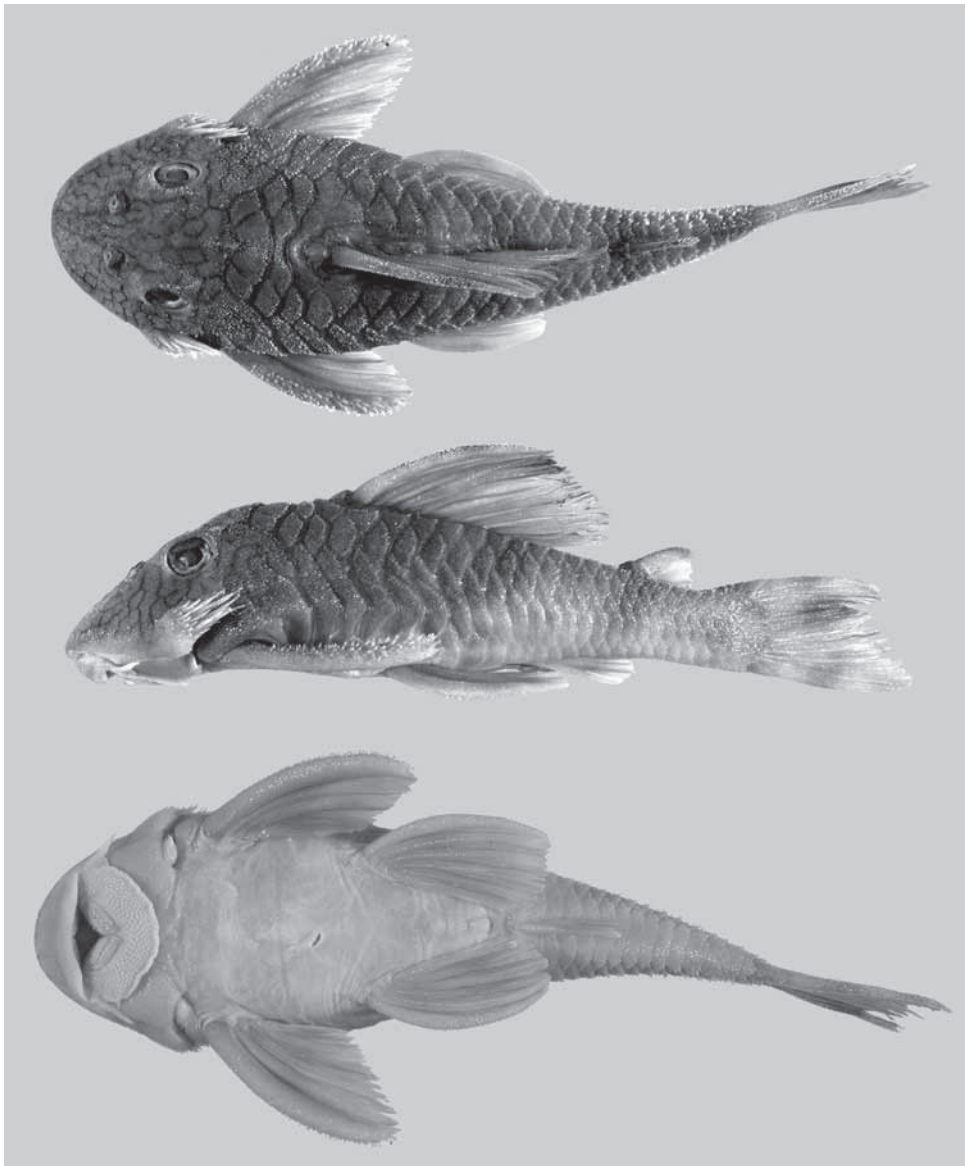

FIGURE 7. Dorsal, lateral, and ventral views of *Peckoltia braueri*, AUM 36228, 95.4 mm SL. Photographs by D. C. Werneke.

Material Examined: GUYANA, Region 9 (Upper Takutu – Upper Essequibo), Takutu River - Negro River drainage: ANSP 180206, 12, 44.8–91.7 mm SL and AUM 36228, 20, 4 cs, 44.7–96.5, Takutu River ca. 2.75 km W Saint Ignatius, 03°21'18"N, 059°49'51", 5–6 November 2002, J.W. Armbruster, M.H. Sabaj, D.C. Werneke, C.L. Allison, M.R. Thomas, C.J. Chin, D. Arjoon, and L. Atkinson; ANSP 180207, 2, 39.8–50.6 and AUM 35525, 3, 84.1–66.0, Pirara River, tributary of the Ireng River, 3.5 km NNW Pirara, 03°38'55"N, 059°41'20", 2 November 2002, J.W. Armbruster, M.H. Sabaj, M.R. Thomas, D.C. Werneke, and D. Arjoon; ANSP 180208, 1, 93.5 and AUM 38882, 2, 77.7–103.0, same locality as ANSP 180206, 1 November 2003, J.W. Armbruster, M.H. Sabaj, M. Hardman, D. Arjoon, N.K. Lujan, and L.S. de Souza; and AUM 37914, 1, not measured, Takutu River at Saint Ignatius, 1.86 km NNE Lethem, 03°21'20"N, 059°48'19", 2 November 2003, J.W. Armbruster, M.H. Sabaj, M. Hardman, D. Arjoon, N.K. Lujan, and L.S. de Souza; AUM 44593, Ireng River at Sunnyside, 03°44'37"N., 059°40'11"W, L.S. de Souza, N.K. Lujan, D.C. Taphorn, J.A. Hartsell, E. Liverpool, and S. Lord, 26 November 2005; AUM 44673, Pirara River at Pirara Ranch, 03°37'31"N, 059°40'37"W, L.S. de Souza, N.K. Lujan, D.C. Taphorn, J.A. Hartsell, E. Liverpool, and S. Lord, 26 November 2005; AUM 44710, Takutu River near Lethem, 03°28'14"N, 059°48'36"W, L.S. de Souza, N.K. Lujan, D.C. Taphorn, J.A. Hartsell, E. Liverpool, and S. Lord, 27 November 2005.

BRAZIL, Roraima, Rio Negro drainage: MZUSP 33703, 1, 83.6, and MZUSP 34652, 1, 62.0, Rio Branco, Bem Querer rapids, 8 January 1984, M. Goulding; MZUSP 34563, 5, 74.7–82.4. Igarapé do Cujobim, in front of Ilha de Maracá, 13 January 1984, M. Goulding.

Diagnosis: *Peckoltia braueri* can be identified from all other described *Peckoltia* except *P. cavatica* by the presence of an orange band at the edge of the dorsal and caudal fins and by having thin, wavy, black lines that tend to outline the plates and bones of the head (Figs. 2b and 7). *Peckoltia braueri* can be identified from *P. cavatica* by having the dorsal saddles better developed (vs. barely visible), by having the head plates and bones not completely outlined in black and with lines intense (vs. having all of the head plates and bones completely outlined in black and with the lines lighter), by having black vermiculations on the compound pterotic (vs. no vermiculations), by having at least one, broken band in the caudal fin (vs. no bands in the caudal fin), and by having the marginal orange band of the dorsal and caudal fins not as thick or as intense as in *P. cavatica*. The only other species of *Peckoltia* with wavy lines on the head are *P. caenosa*, *P. lineola* and *P. vermiculata*. *Peckoltia braueri* can be identified from *P. caenosa* and *P. lineola* by having narrow vermiculations on the head (narrower than the pupil vs. about the same width of the pupil) forming a net (vs. several distinct lines and some separate spots), and by having the plates of the nape outlined in black (vs. nape plates not outlined); from *P. caenosa* by lacking markings on the abdomen (vs. vermiculations), by having bands in the dorsal (vs. light spots) and by having the dark and light bands on the caudal fin of about equal width (vs. light bands about 25% of width of dark bands); and from *P. vermiculata* by having vermiculations that do not radiate from a central point on the parieto-supraoccipital (vs. vermiculations mostly combined to the parieto-supraoccipital and radiating from a central point), and by having the nape plates outlined with black (vs. nape plates not outlined).

Description: *Peckoltia brueri* was recently redescribed by Armbruster and Werneke (2005). Morphometrics in Table 1.

Range: Collected from three localities around Lethem in the Takutu and Pirara Rivers (Fig. 8). Found in swift riffles among very large boulders. Also known from the mainstem Rio Branco near Caracarai and the Rio Uraricoera drainage of Brazil.

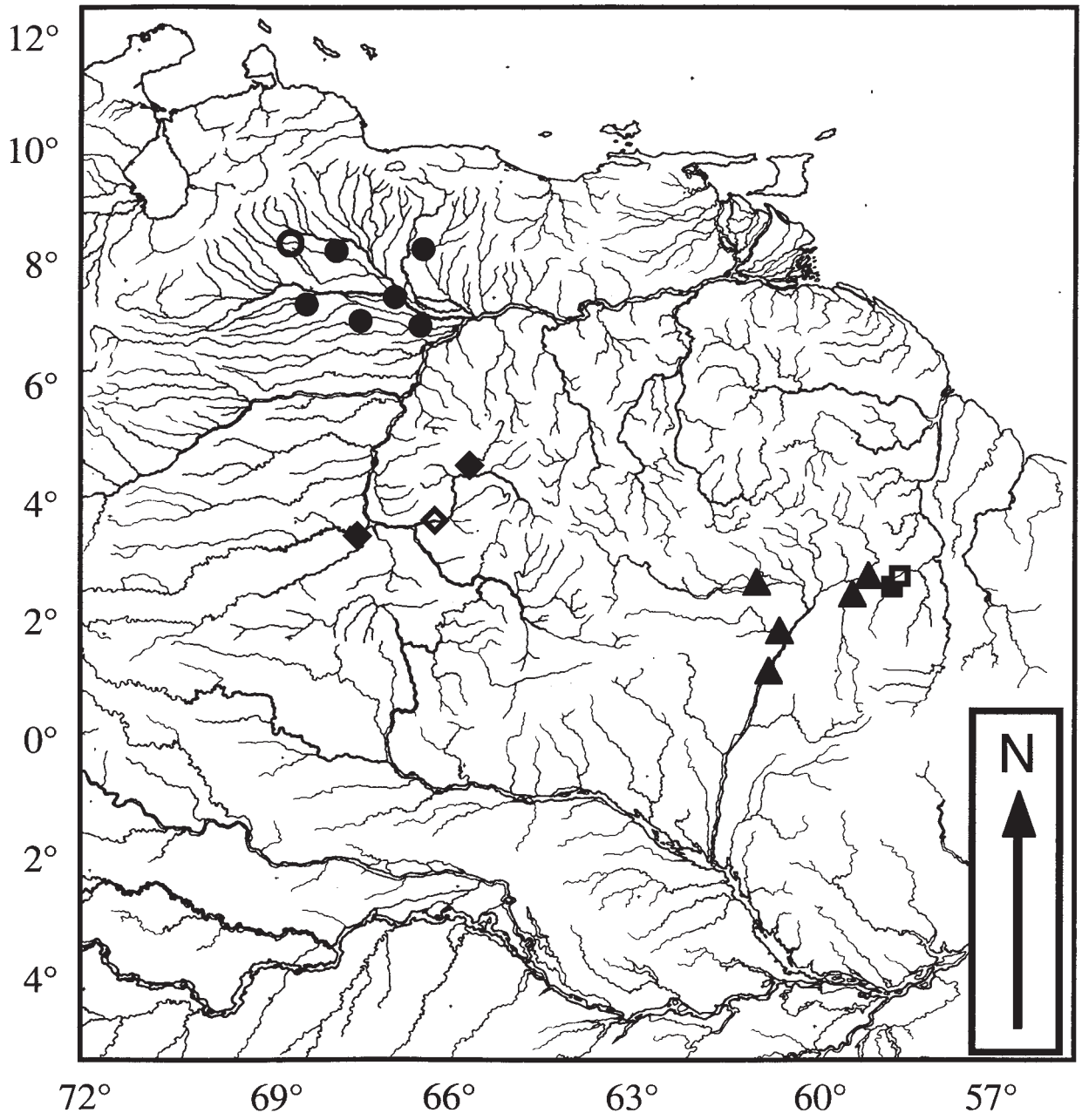

FIGURE 8. Distribution of *Peckoltia braueri* (triangles), *P. caenosa* (circles), *P. cavatica* (squares) and *P. lineola* (diamonds). Open symbols are type localities; the type locality for *P. braueri* is not adequate to plot on the map. Symbols may represent more than one locality

***Peckoltia brevis* (La Monte 1935)**
(Fig. 2c and 9–10)

Hemiancistrus brevis La Monte, 1935:3, fig. 2. Type locality: Near Sena Madureira, near mouth of River Macaua, tributary of Rio Iaco, itself a tributary to Rio Purus, Amazonas, Brazil. Holotype: AMNH 12602.

Material Examined: BOLIVIA, Unknown state, Río Mamore - Río Madeira drainage: MNHN 1988–1083, 2, 65.1–103.0, Isiboro, col. by, Luzanne and Loubens, October 1985; MNHN 1988–1084, 1, 92.6, Chimimita, col. by, Luzanne and Loubens, November 1984. BOLIVIA, Beni, Río Madeira - Río Amazonas drainage:

USNM 305824, 10, 3 cs., 34.1–101.2, Ballivia Province, Rio Matos Below Road crossing, 48 Km E San Borja, 14°55'S, 066°17'W, col. by, Starnes, W. C.; Munroe, T.; Sarmiento J., 31 August 1987.

BRAZIL, Acre, Rio Amazonas drainage: AMNH 12602, Holotype, and USNM 94680, 1, 84.1, vicinity of mouth of Rio Macauhan, a tributary of the Rio Yacu, which flows into the Rio Purus, col. by, B.A. Krukoff, 1934; MZUSP 50395, 1, 88.1, Rio Juruá, Colocacão São João, 09°09'S, 072°41'W, col. by, Coleção Reserva Extrativista Alto Juruá, 8 July 1993. BRAZIL, Amazonas, Rio Amazonas drainage: MZUSP 23439, Igarapé Tome, Ati Paraná, NW of Fonte Boa, 02°31'S, 066°06'W, col. by, EPA, 13 October 1968; INPA 4705, 3, 98.1–106.0, Rio Japurã, Paraná do Mapixari, Lago Jarava, col. by, C. Pescad. de Tefe, 1 December 1979; MZUSP 57474, Rio Solimões, above the Rio Purus, col. by, A. M. Zanata *et al.*, 28 July 1996.

COLOMBIA, Amazonas, ICNMNH 7944, Río Amazonas drainage, San Juan de Atacuan, Rio Amazonas, 10 July 1993. COLOMBIA, Vichada, ICNMNH 5339, Río Orinoco drainage, La Pinsonera, Río Bita, Puerto Carreño, Javier Climato, 23 Jan 1998; ICNMNH 11922, Río Orinoco basin, Puerto Carreño, collected by Proyecto Ornamentales del Orinoco, February 2005.

PERU, Loreto, Río Amazonas drainage: FMNH 111511, 1, 92.6, Rio Chambira and small tributaries ca. 15.7 km above mouth in Rio Marañon, 05°00'S, 074°53'W, col. by, Chernoff, Wheeler, Klocek, Duvall and Onate, 4 September 1988; INHS 36873, 1, 95.5, Río Itaya approximately 10 km S Santa Clara, col. by, aquarium dealer in Santa Clara, 25 July 1995; Peru, Loreto, Río Amazonas, INHS 43344, 2, 1 cs, 105.3–105.7 and SIUC 29784, 2, 58.5–73.3, Río Itaya 11 km SSW Iquitos, 03°49'48"S, 073°18'03"W, col. by, J.W. Armbruster, M.H. Sabaj, *et al.*, 6 August 1997.

FIGURE 9. Lateral view of holotype of *Hemiancistrus brevis*, 86.7 mm SL. Photograph by M. Stiassny.

Diagnosis: *Peckoltia brevis* can be identified from all other *Peckoltia* except *P. bachi, P. caenosa, P. lineola, and P. oligospila* by having round spots on the head and abdomen; from *P. bachi* by having the spots on the head small (vs. large), the pelvic spines narrow (vs. wide), and the eye high on the head (vs. low); from *P. caenosa* and *P. lineola* by having none of the head spots combining to form lines; from *P. caenosa* by having spots on the abdomen (vs. vermiculations), by having bands in the dorsal (vs. light spots), and by having the dark and light bands on the caudal fin of about equal width (vs. light bands about 25% of width of dark bands); and from *P. oligospila* by lacking spots laterally behind the dorsal fin (vs. spots present on sides), and by having bands in the dorsal and caudal fins and dorsal saddles (vs. spots on the fins and body and saddles faint). *Peckoltia furcata* additionally has spots on the head, but not the abdomen and *P. brevis* can be further separated from *P. furcata* by having bands in the dorsal fin (vs. spots).

Description: Morphometrics in Table 2, counts based on 24 individuals unless otherwise stated. Largest specimen examined 105.7 mm SL. Body stout and fairly wide. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall, rounded crest. Parieto-supraoccipital crest raised slightly above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from

rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth. Eye medium-sized.

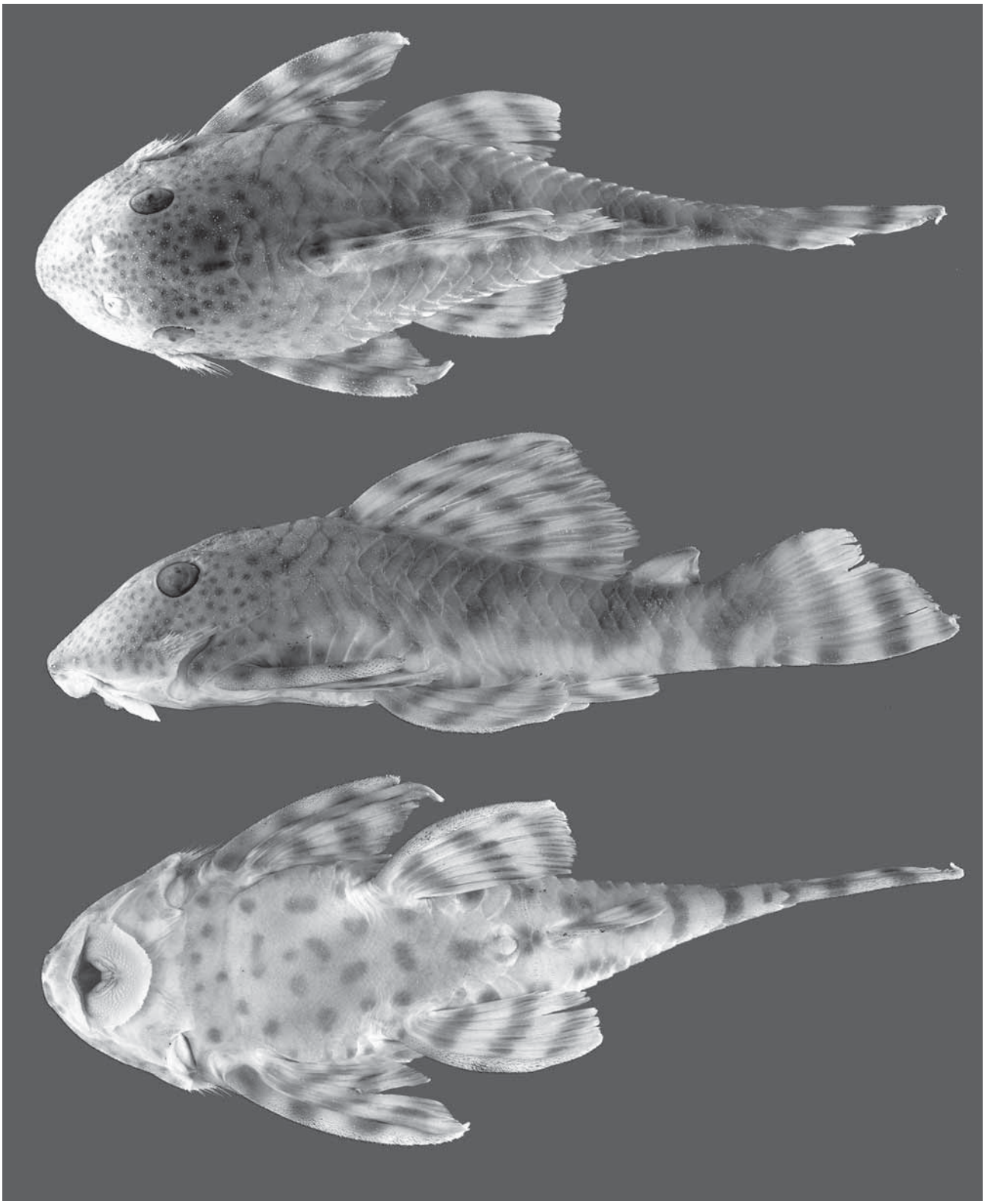

FIGURE 10. Dorsal, lateral, and ventral views of *Peckoltia brevis*, INHS 43344, 105.3 mm SL. Photographs by J.W. Armbruster.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges.

Five rows of plates on caudal peduncle. Abdomen fully covered in small plates except for small naked areas posterior to lower lip and at insertions of paired fins. First anal-fin pterygiophore exposed to form a platelike structure. Pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 22–26 (mode 24) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 14–42 (N=13), longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, just reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with four to five (mode four) dorsal procurrent caudal-fin rays and three to five (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and approximately same length of first branched ray. Anal fin I,4, Pectoral-fin spine almost reaching just beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming very acute angle, premaxillaries forming angle of 90° to slightly greater than 90°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; seven to 22 dentary teeth (mode 14), six to 22 premaxillary teeth (mode 13).

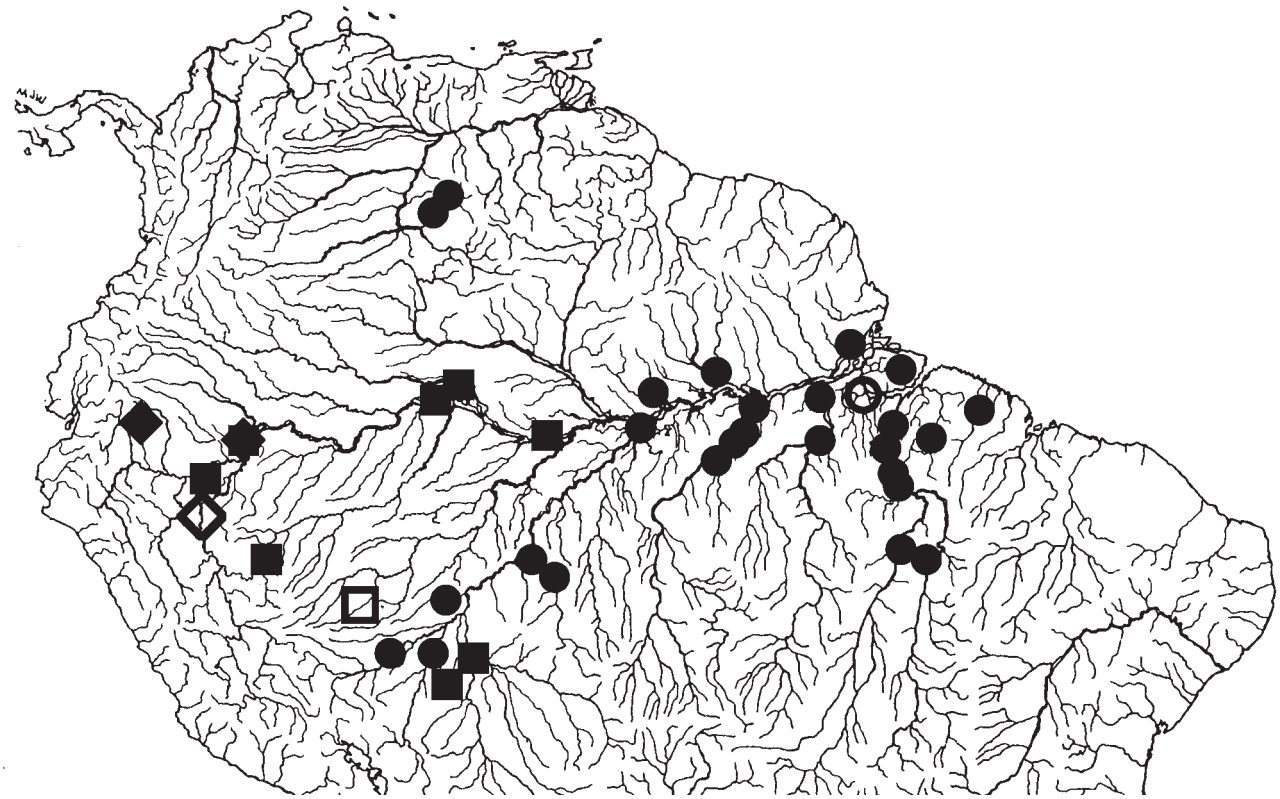

FIGURE 11. Distribution of *Peckoltia brevis* (squares), *P. furcata* (diamonds), and *P. vittata* (circles). Open symbols are type localities. Symbols may represent more than one locality.

Color: Base color light tan with brown markings. Head with small to medium spots, spots fading in region between head and dorsal fin. Parieto-supraoccipital crest dark. Body with four dorsal saddles, the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth at the end of the caudal peduncle. The first two saddles combine at the midline or may fuse completely. Head slightly darker from tip of snout to anterior edge of orbits and medially from posterior edge of frontal to posterior edge of parieto-supraoccipital. All fins with dark bands with dark and light areas of approximately equal width, caudal bands may be irregular. Number of bands increases with size. Dark spot present between dorsal-fin spinelet and spine, and occasionally dark spots present at the bases of the dorsal-fin membranes (darkest anteriorly). Abdomen with medium spots anteriorly and large spots posteriorly. Lower surface of caudal peduncle mottled. Juveniles colored as adults, but with fewer spots on head and few spots (if any) on abdomen.

Sexual Dimorphism: Nuptial males with hypertrophied odontodes on sides and posterior part of head; hypertrophied odontodes becoming larger posteriorly. Hypertrophied odontodes on upper caudal-fin spine and adipose spine. Upper caudal-fin spine thickened. Odontodes on pectoral-fin spine not noticeably larger.

Range: From the Rios Purus, Juruá, Marañon and upper Amazon of Brazil and Peru and also found in the upper Río Madeira of Bolivia (Fig. 11). Two collections from the Río Orinoco basin in Vichada, Colombia appear to be *Peckoltia brevis*. If it wasn't for the fact that no other collections of *P. brevis* have been found north of mainstem Amazon/Marañon and lower Caquetá, and if the range was not bisected by the range of *P. lineola*, I would not hesitate to call these specimens *P. brevis*. The specimens are small (48.0–70.2 mm SL); however, the largest specimen is developing nuptial male odontodes at a size I have not seen before. Certainly more specimens must be found to determine the range of *P. brevis*. Because of the uncertainty of the identity of the Vichada specimens, I have not included them in the morphometrics or meristics of the species.

Habitat: Specimens collected in Peru were from a lowland, muddy-bottomed river. The specimens were collected on and in submerged logs.

***Peckoltia caenosa* new species**
(Fig. 12)

Holotype: MCNG 42665, 135.1 mm SL, VENEZUELA, Portuguesa, Río Orinoco dr.: Caño Maraca, tributary of Caño Igues – Río Portuguesa, Guanare-Guanarito road at road km 60, 08°49'39"N, 069°20'42"W, 17 December 1999, J.W. Armbruster, M. Hardman, J.D. Evans, and J.A. Thomas.

Paratypes: All collections Río Orinoco drainage: ANSP 166749, 3, 69.4–119.7, VENEZUELA, Anzoategui, Río Orinoco dr., Soledad, Lago Tineo, 08°11'25"N, 063°28'20"W, 15 April 1986, M. Rodriguez and S. Richardson; VENEZUELA, Apure: MCNG 9721, 1, 93.8, Cao Terecay, 35 Km to the north of the road to Modulos field station, 0750'20"N, 069°19'00" W, 18 March 1981, D.C. Taphorn; MCNG 37452, 1, 123.1, Río Arauca, in El Yagual, ~07°27'31"N, ~068°25'24"W, 14 November 1997, Astudillo and Martinez; MCNG 38972, 1, 133.8, Río Manglar 500 meters from the bridge, D. Arana; VENEZUELA, Cojedes: MCNG 24200, 1, 72.6, Cao Igues, via Arismendi, south of El Baul, 1990. VENEZUELA, Portuguesa: AUM 18946, 4, 1 cs, 93.4–156.9, same data as holotype; AUM 22836, 1, 69.4 and ANSP 180224, 1, 134.1, same locality as holotype, 1 January 2000, J.W. Armbruster, M. Hardman, J.D. Evans, and J.A. Thomas; UF 32382, 2, 81.2–94.4, same locality as holotype, 27 March 1981, C.R. Gilbert and C.G. Lilyestrom.

Nontype (Not included as paratypes because they are faded and difficult to confirm identification): USNM 258213, 1, not measured, VENEUELA, Guarico, Río Orinoco dr., Río Orituco where crossed by road from Calabozo, 27 January 1983, A. Machado *et al.*; USNM 258215, 1, not measured, Apure, main channel of Río Apure in region of San Fernando de Apure, 07°53'N, 067°29'W, 25 January 1983, Technicians of Apure Fisheries.

Diagnosis: *Peckoltia caenosa* can be identified from all other species of *Peckoltia* by having dark vermiculations on the abdomen (vs. spots, long, fairly straight, wide lines, or plain); from all except *P. bachi* by having the dorsal and lateral surface of the body mottled (vs. with spots or saddles); and from *P. bachi* by having the spots on the head small (vs. large) and generally forming vermiculations (vs. separate), the pelvic spines narrow (vs. wide), and the eye high on the head (vs. low).

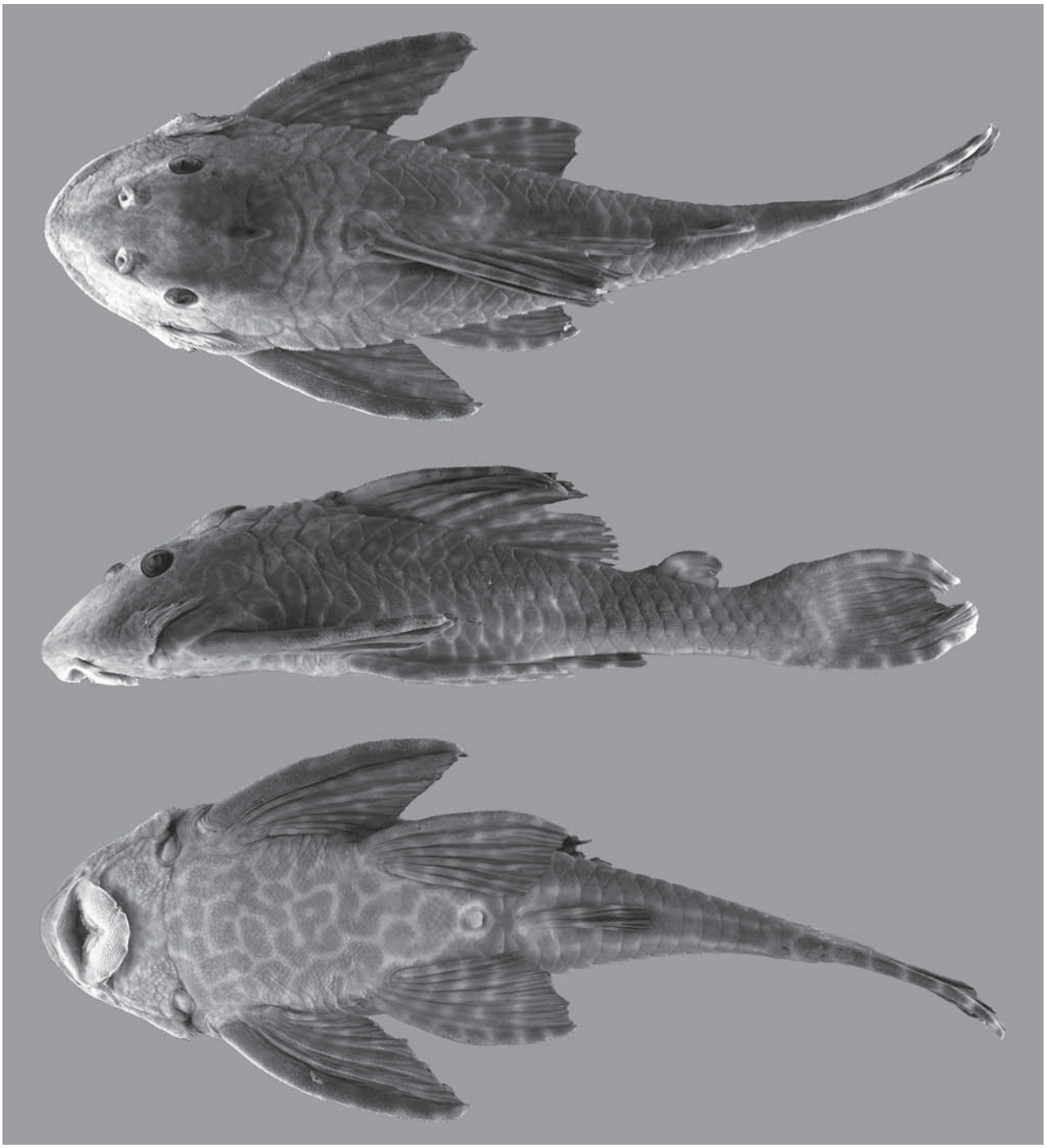

FIGURE 12. Dorsal, lateral, and ventral views of the holotype of *Peckoltia caenosa* MCNG 42665, 156.9 mm SL. Photographs by J.W. Armbruster.

TABLE 2. Selected morphometrics of *Peckoltia brevis* and *P. caenosa*. Numbers in parentheses refer to landmark numbers in Armbruster (2003). Measurements are ratios of SL (predorsal l. to pelvic-dorsal l.) or head l. (head-eye l. to premaxillary tooth cup l.).

	P. brevis					*P. caenosa*				
	N	Avg.	SD	Min.	Max.	N	Avg.	SD	Min.	Max.
SL (1-20)	24	74.5	26.1	34.1	106	17	103.8	29.3	61.3	156.9
Predorsal L. (1-10)	24	44.9	1.7	42.1	48.4	17	41.1	1.2	38.3	43.4
Head L. (1-7)	24	37.6	2.2	35.1	43.0	17	34.7	1.4	31.2	36.6
Head-dorsal L. (7-10)	24	7.5	1.1	5.2	9.7	17	6.8	0.8	6.0	8.3
Cleithral W. (8-9)	24	29.0	1.8	25.3	32.4	17	28.5	1.4	25.7	31.1
Head-pectoral L. (1-12)	24	27.9	1.2	25.6	30.4	17	26.5	2.0	23.9	30.5
Thorax L. (12-13)	24	23.0	1.6	20.2	25.6	17	22.7	1.5	20.4	25.8
Pectoral-spine L. (12-29)	24	32.6	2.7	27.5	37.7	17	34.9	1.9	30.9	38.3
Abdominal L. (13-14)	24	22.7	2.1	19.8	31.3	17	22.3	0.9	20.8	23.9
Pelvic-spine L. (13-30)	24	27.9	1.9	23.9	32.9	17	27.5	2.1	21.4	29.9
Postanal L. (14-15)	24	33.2	1.5	29.8	35.5	17	36.3	1.3	33.2	38.3
Anal-fin spine L. (14-31)	23	15.4	1.9	11.7	17.7	17	16.5	1.6	11.9	18.8
Dorsal-pectoral D. (10-12)	20	30.5	1.3	28.2	33.6	17	27.5	0.9	25.8	29.6
Dorsal spine L. (10-11)	24	35.2	3.0	27.5	40.5	16	34.5	3.3	30.0	41.8
Dorsal-pelvic D. (10-13)	24	24.4	2.8	18.9	29.1	17	23.4	1.4	20.2	25.1
Dorsal-fin base L. (10-16)	24	26.2	1.6	23.4	29.0	17	26.4	1.3	24.1	29.4
Dorsal-adipose D. (16-17)	24	13.9	2.7	9.5	19.0	17	17.9	1.8	14.9	21.4
Adipose-spine L. (17-18)	23	11.8	1.7	9.1	15.0	17	9.2	1.3	7.8	12.6
Adipose-up. caudal D. (17-19)	24	19.1	3.1	12.0	24.8	17	17.6	2.0	14.0	22.8
Caudal peduncle Dp. (15-19)	24	11.4	1.5	8.4	14.9	17	11.3	0.7	9.7	12.3
Adipose-low. caudal D. (15-17)	24	23.9	2.1	21.0	28.7	17	22.5	1.3	20.5	25.5
Adipose-anal D. (14-17)	24	18.5	1.9	14.6	22.8	17	20.8	1.7	18.0	23.2
Dorsal-anal D. (14-16)	24	16.6	1.5	14.0	20.2	17	14.7	0.6	13.2	16.0
Pelvic-dorsal D. (13-16)	24	27.0	1.6	24.0	30.9	17	25.6	1.2	23.5	27.7
Head-eye L. (5-7)	24	37.8	1.6	34.5	41.0	17	38.2	1.3	34.7	40.2
Orbit Dia. (4-5)	24	18.3	1.6	15.3	21.4	17	16.6	2.6	13.8	23.9
Snout L. (1-4)	24	58.2	3.2	52.4	64.3	17	57.6	2.0	53.7	61.0
Internares W. (2-3)	24	16.8	1.8	13.8	20.7	17	15.8	1.9	11.4	18.9
Interorbital W. (5-6)	24	42.4	4.3	36.9	56.3	17	41.0	4.4	27.8	46.3
Head Dp. (7-12)	24	71.4	4.0	63.6	77.4	17	70.2	1.7	66.6	74.0
Mouth L. (1-24)	24	45.0	2.2	41.4	48.2	17	43.5	2.2	40.1	48.0
Mouth W. (21-22)	24	41.1	2.4	36.2	45.3	17	40.1	3.9	32.8	50.7
Maxillary barbel L. (22-23)	24	14.8	3.4	9.7	21.0	17	17.3	3.5	11.7	24.8
Dentary tooth cup L. (25-26)	21	12.0	2.0	7.2	16.7	17	12.4	1.6	8.3	16.0
Premax. tooth cup L. (27-28)	21	11.7	1.9	8.2	15.6	17	11.5	1.7	8.3	15.9

Description: Morphometrics in Table 2, counts based on 17 individuals. Largest specimen examined 156.9 mm SL. Body stout and fairly wide. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall, rounded crest giving head the appearance of stepping to greater depth. Parieto-supraoccipital crest

raised slightly above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth. Eye relatively small.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen fully covered in small plates except for small naked areas posterior to lower lip and at insertions of paired fins. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 25–27 (mode 26) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 10–58, longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, not reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin strongly forked, lower lobe longer than upper, I,14,I with four to five (mode five) dorsal procurrent caudal-fin rays and four to five (mode four) ventral procurrent-fin rays. Anal fin short with spine weak and approximately same length of first ray. Anal fin I,4, Pectoral-fin spine almost reaching anus when adpressed ventral to pelvic fin. Pectoral fin I,6 (one anomalous specimen I,8). Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming very acute angle, premaxillaries forming angle of 90° to slightly greater than 90°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; 10–18 dentary teeth (mode 15), 11–21 premaxillary teeth (mode 17).

Color: Mottled with light and dark brown. Dark spots all generally combining to form vermiculations on dorsal surface of head. Light spots on fin spines and rays, membranes of caudal fin also with light marking so that spots combine to form bands, light bands about 25% width of dark bands. Four dorsal saddles present, slightly darker than surrounding areas: first below anterior portion of dorsal fin, second below posterior portion of dorsal fin and slightly posterior, third below adipose fin and fourth at base of caudal fin. Nasal flap and parieto-supraoccipital crest slightly darker than rest of head. Ventral surface slightly lighter than sides. Abdomen covered with brown spots that combine to form vermiculations. Ventral surface of caudal peduncle with light, wavy stripes. Juveniles colored as adults, but with fewer, relatively larger spots on abdomen, some of which are not combined to form vermiculations.

Sexual dimorphism: None observed.

Range: Found in the llanos of Venezuela in rivers draining into the middle Río Orinoco (Fig. 8).

Habitat: Found in slow-flowing muddy streams. Can be found during the day inside of submerged, hollow logs.

Etymology: From the Latin *caenosus* meaning muddy or dirty, in reference to the muddy coloration of this species and its preference for muddy habitats.

***Peckoltia cavatica* Armbruster and Werneke 2005**
(Figs. 2d and 13)

Peckoltia cavatica Armbruster & Werneke, 2005: 8, figs. 2 (bottom), 4. Type locality: Guyana, Rupununi (Region 9), 3.7 km SSE Massara, 03.86228º, –059.28439º. Holotype: UG/CSBD 11043.

Material Examined: All collections GUYANA, Region 9 (Upper Takutu- Upper Essequibo), Essequibo River drainage: ANSP 180209, 3, Paratypes, 29.8–58.2, AUM 35536, 5, 2 cs, Paratypes, 32.8–71.8 mm SL, and UG/CSBD 11045, Paratypes, 2, 33.1–55.1 mm SL, Guyana, Rupununi (Region 9), Rupununi River, 4.6 km NW Massara, 03°55'34"N, 059°16'49"W, 26 October 2002, col. by J.W. Armbruster, M.H. Sabaj, D.C. Werneke, C.L. Allison, M.R. Thomas, C.J. Chin, D. Arjoon, S.M. James, and S. Mario; ANSP 180210, 3, Paratypes, 28.4–52.8 mm SL, AUM 36229, 6, 4 cs, Paratypes, 27.5–58.2, UG/CSBD 11043, 1, Holotype, 71.8 mm SL, and UG/CSBD 11044, 3, Paratypes, 32.3–43.4 mm SL, 3.7 km SSE Massara, 03°51'44"N, 059°17'04"W, 27 October 2002, col. by J.W. Armbruster, M.H. Sabaj, D.C. Werneke, C.L. Allison, M.R. Thomas, C.J. Chin, D. Arjoon, S. MaRio, and S.M. James; AUM 44812, Rupununi River at Yukupari, 03°39'54"N, 059°20'38"W, col. by L.S. de Souza, N.K. Lujan, D.C. Taphorn, J.A. Hartsell, E. Liverpool, and S. Lord; USNM 372572, 1, Paratype, 70.0 mm SL, Guyana, Rupununi (Region 9), Rupununi River, rock area near Massara, 23 November 2001, col. by D. Arjoon.

FIGURE 13. Dorsal, lateral, and ventral views of the holotype of *Peckoltia cavatica* UG/CSBD 11043, 71.8 mm SL. Photographs by D. C. Werneke.

TABLE 3. Selected morphometrics of *Peckoltia cavatica* and *P. furcata*. Numbers in parentheses refer to landmark numbers in Armbruster (2003). Measurements are ratios of SL (predorsal l. to pelvic-dorsal l.) or head l. (head-eye l. to premaxillary tooth cup l.).

	P. cavatica					*P. furcata*				
	N	Avg.	SD	Min.	Max.	N	Avg.	SD	Min.	Max.
SL (1-20)	25	50.3	12.1	35.8	71.8	12	106.5	25.9	75.9	153.5
Predorsal L. (1-10)	25	45.3	1.0	43.4	46.6	12	41.6	1.7	38.3	44.6
Head L. (1-7)	25	39.8	1.6	37.6	46.2	12	33.2	1.7	30.4	35.9
Head-dorsal L. (7-10)	25	6.2	1.0	3.9	7.6	12	8.6	1.4	6.3	11.1
Cleithral W. (8-9)	25	30.5	1.1	28.1	32.3	12	24.8	2.4	20.8	28.3
Head-pectoral L. (1-12)	25	28.3	1.3	25.1	31.4	12	24.2	1.0	22.5	26.2
Thorax L. (12-13)	25	23.6	1.3	20.7	26.2	12	23.9	2.3	21.1	29.1
Pectoral-spine L. (12-29)	25	31.9	1.9	27.0	34.5	12	29.8	2.7	26.0	34.7
Abdominal L. (13-14)	25	21.9	1.7	17.8	24.6	12	22.3	1.2	20.7	24.0
Pelvic-spine L. (13-30)	25	27.0	1.1	24.1	29.0	12	27.6	1.9	24.5	30.7
Postanal L. (14-15)	25	34.4	1.4	31.3	36.9	12	35.2	2.2	32.2	39.5
Anal-fin spine L. (14-31)	25	12.7	1.2	9.5	14.6	12	15.7	1.5	13.1	18.3
Dorsal-pectoral D. (10-12)	25	30.8	1.0	28.2	32.4	12	27.5	1.3	25.8	29.6
Dorsal spine L. (10-11)	25	33.4	3.6	23.0	38.5	11	36.3	3.5	30.6	39.9
Dorsal-pelvic D. (10-13)	25	23.8	2.4	18.6	29.8	12	23.1	1.8	19.9	26.6
Dorsal-fin base L. (10-16)	25	27.1	1.7	23.7	30.7	12	28.2	0.6	27.0	29.1
Dorsal-adipose D. (16-17)	25	12.4	1.3	10.1	14.9	12	14.8	1.8	12.6	17.6
Adipose-spine L. (17-18)	25	10.9	1.0	9.0	12.5	12	10.0	1.5	7.6	12.7
Adipose-up. caudal D. (17-19)	25	20.4	1.5	17.5	22.5	12	18.6	1.9	15.8	22.8
Caudal peduncle Dp. (15-19)	25	10.4	1.5	7.9	13.5	12	10.6	1.6	7.6	12.6
Adipose-low. caudal D. (15-17)	25	26.4	1.2	24.6	28.5	12	23.8	2.1	20.8	28.4
Adipose-anal D. (14-17)	25	16.2	1.3	13.7	19.0	12	18.9	1.1	17.7	21.4
Dorsal-anal D. (14-16)	25	16.4	1.1	13.7	18.3	12	16.4	0.8	15.2	17.4
Pelvic-dorsal D. (13-16)	25	24.4	2.5	18.9	28.5	12	27.4	2.1	24.1	30.0
Head-eye L. (5-7)	25	36.1	2.3	32.5	42.0	12	36.4	1.6	33.3	38.7
Orbit Dia. (4-5)	25	22.2	0.8	20.5	23.7	12	17.4	1.9	14.5	21.1
Snout L. (1-4)	25	55.3	3.6	45.7	60.4	12	59.1	2.4	55.4	63.1
Internares W. (2-3)	25	16.6	2.7	12.0	20.8	12	12.8	0.9	11.5	14.3
Interorbital W. (5-6)	25	39.7	2.6	31.7	43.1	12	38.8	3.1	32.3	43.2
Head Dp. (7-12)	25	68.8	2.4	61.8	71.8	12	68.7	1.4	66.6	72.1
Mouth L. (1-24)	25	43.0	2.8	38.2	50.6	12	40.1	4.6	30.6	46.2
Mouth W. (21-22)	25	40.5	3.0	34.1	45.5	12	40.9	5.5	32.8	50.0
Maxillary barbel L. (22-23)	25	15.0	2.4	10.5	18.4	12	13.4	2.4	9.9	16.7
Dentary tooth cup L. (25-26)	25	8.3	1.6	5.4	11.4	12	12.8	2.1	8.9	16.3
Premax. tooth cup L. (27-28)	25	7.9	1.2	5.5	10.5	12	13.2	1.6	10.5	15.8

Diagnosis: *Peckoltia cavatica* can be identified from all other described *Peckoltia* except *P. braueri* by the presence of an orange band in the dorsal fin and by having thin, black lines that outline the plates and bones of the head. *Peckoltia cavatica* can be identified from *P. braueri* as above The only other species of

Peckoltia similar to *P. cavatica* in coloration are *P. lineola* and *P. vermiculata*, which can be identified by having vermiculations on the dorsal head bones and plates (vs. coloration confined to the borders between bones and plates in *P. cavatica*).

Description: *Peckoltia cavatica* was recently described by Armbruster and Werneke (2005). Morphometrics in Table 3.

Range. Collected from two localities around the Macushi village of Massara near Anai in the Rupununi River (Fig. 8).

***Peckoltia furcata* (Fowler 1940)**
(Figs. 14–15)

Chaetostomus furcatus Fowler, 1940: 238, figs. 28–29. Type locality: Ucayali River basin, Contamana, Peru. Holotype: ANSP 68655.

Material Examined: ECUADOR, Pastaza, Río Napo - Río Amazonas drainage: FMNH 70863, 4, 1 cs, 75.9–87.4, Cusuimi, on Rio Cusuimi, about 150 km SE of Puyo, 02°39'S, 077°43'W, col. by B. Malkin, 18–23 July 1971. PERU, Amazonas, Río Amazonas drainage: ANSP 68655, Holotype, 1, 90.7, Ucayali River basin, Contamana, W.C. Morrow, July-August 1937; MUSM 19052, 3, 122.8–153.5, Río Santiago ce.nn. Soledad, Río Marañon basin, 03°31'28"S, 77°46'20"W, col. by M. Hidalgo, 20 September 2001; FMNH 97023, 1, 105.9 and LACM 39864–10, 2, 1 cs, 92.7–98.9, Rio Santiago, vicinity of Galilea, 1.5 km upstream of La Poza, Río Marañon basin, col. by Natives, 26–28 January 1980. PERU, Loreto, Río Amazonas drainage: SIUC 36691, 1, 139.4, Río Itaya, 10 km S of Santa Clara, ornamental fishermen, 25 July 1995.

Diagnosis. *Peckoltia furcata* is unique among *Peckoltia* and perhaps hypostomines by having a strongly forked caudal fin with the upper lobe longer than the lower (Fig. 15; vs. lower lobe longer); however, the condition of the caudal fin of most *Peckoltia* is poor with the tails either breaking in transit or eaten off by other fishes, making the utility of this character limited. *Peckoltia furcata* can be identified from all other *Peckoltia* except *P. bachi, P. brevis, P. caenosa, P. lineola,* and *P. oligospila* by having spots on the head; from *P. bachi* by having the spots on the head small (vs. large), the pelvic spines narrow (vs. wide), and the eye high on the head (vs. low); from *P. brevis, P. caenosa, P. lineola,* and *P. oligospila* by lacking spots on the abdomen at all ages (vs. present in large juveniles and adults); from *P. brevis* and *P. lineola* by having spots on the dorsal fin (vs. bands); from *P. caenosa* and *P. lineola* by having none of the spots on the head combining to form vermiculations; from *P. caenosa* by having dark spots in the dorsal fin (vs. light spots), and by having the dark and light bands on the caudal fin of about equal width (vs. light bands about 25% of width of dark bands); and from *P. oligospila* by having bands in the caudal fin (vs. spots).

FIGURE 14. Lateral view of holotype of *Chaetostomus furcatus*, ANSP 68655, 90.7 mm SL. Photograph by K. Luckenbill.

Description. Morphometrics in Table 3, counts based on 12 individuals unless otherwise stated. Largest specimen examined 153.5 mm SL. Body fairly narrow and elongate. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall crest. Parieto-supraoccipital crest raised well above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth except parieto-supraoccipital crest. Eye medium-sized.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen completely covered in small plates except for small areas at bases of pectoral and pelvic fins and occasionally on throat. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 23–28 (mode 26) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 20–77, longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, not reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with four to five (mode four) dorsal procurrent caudal-fin rays and four to five (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and about same length of first branched ray. Anal fin I,4, Pectoral-fin spine reaching beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin or further when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming angle slightly greater than 90°, premaxillaries forming gentle arc greater than 135°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; 26–42 dentary teeth (mode 37), 28–58 premaxillary teeth (mode 30).

Color: Base tan with brown markings. Head with small spots anteriorly, becoming slightly larger posteriorly and fading between head and dorsal fin or continuing to get larger and fading anywhere before caudal fin. Body with four dorsal saddles (occasionally faint), the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth at the end of the caudal peduncle. The first two saddles combine midbody. All fins with large spots, spots combining in all except dorsal fin to form bands (although the distal row will occasionally fuse in the dorsal fin). The light interspaces in all fins except the caudal are about half the width of the dark spots or bands. The light interspaces of the caudal fin about same width as dark bands. Dark spot between dorsal-fin spinelet and spine. Abdomen and ventral surface of caudal peduncle lighter than sides. Juveniles colored as adults, but spots significantly larger and fewer bands or spots in the fins.

Sexual Dimorphism: Nuptial males with hypertrophied odontodes on sides and posterior part of head; hypertrophied odontodes becoming larger posteriorly. Hypertrophied odontodes on upper caudal-fin spine and adipose spine. Upper caudal-fin spine not thickened. Odontodes on pectoral-fin spine noticeably larger.

Range: Known from the upper Río Amazon, Río Marañon, and Río Ucayali of Ecuador and Peru (Fig. 5).

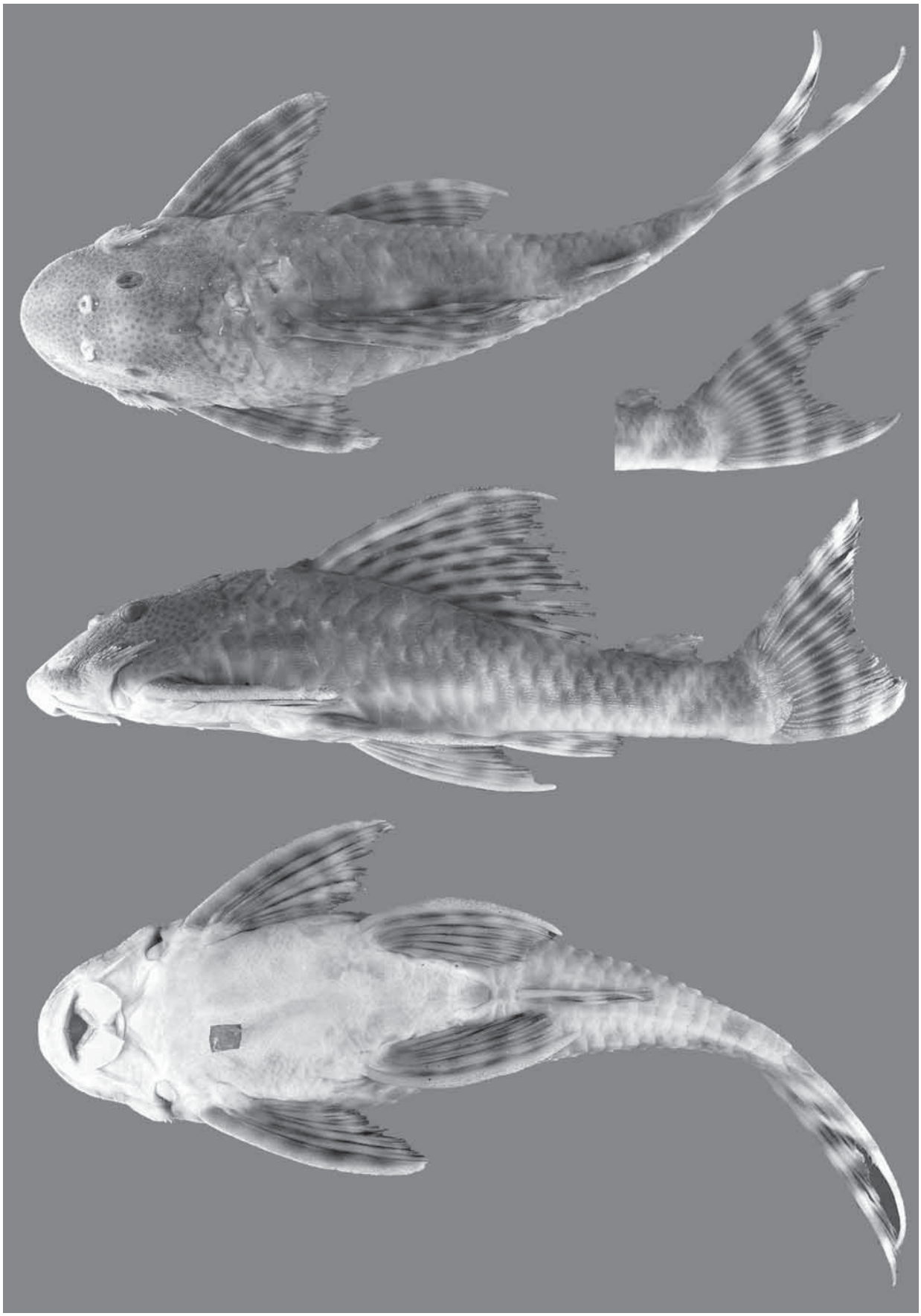

FIGURE 15. Dorsal, lateral, and ventral views of *Peckoltia furcata*, SIUC 36691, 139.4 mm SL. Inset is of extended caudal fin to show that the dorsal caudal-fin spine is longer than the ventral. Photographs by J.W. Armbruster.

Comments: The placement of *Peckoltia furcata* is far from assured. The dentary angle never gets quite to 90°, and it appears intermediate in angle between *Hemiancistrus sabaji* and *Peckoltia*. In most conditions such as color and body shape, *P. furcata* seems intermediate between *H. sabaji* and the rest of *Peckoltia*, but given that the jaw angle is smaller in *P. furcata* than anything I have identified as *Hemiancistrus*, I consider it a *Peckoltia*. Certainly the phylogeny of *Peckoltia* must be better explored to determine the relationships of the species.

Peckoltia lineola **new species**
(Figs. 2e and 16)

Holotype: MCNG 55684, VENEZUELA, Amazonas, Río Orinoco drainage, 88.3, Río Ventuari, 23 km NE of Macuruco, 94 km E of San Fernando de Atabapo, 04°04'50"N, 66°51'55"W, N.K. Lujan, D.C. Werneke, M.H. Sabaj, L.S. de Souza, and O. Leon, 5 April 2004.

Paratypes: COLOMBIA, Guainia, Río Orinoco drainage: ICNMNH 9910, 2, 37.1–57.5, Inirida, Caño Bocon - Río Inirida, M.T. Sierra and M. Patiño, February - March 2004. VENEZUELA, Amazonas, Río Orinoco drainage: ANSP 185222, 2, 1 cs, 88.3–92.5, AUM 39245 2, 1 cs, 88.3–94.7, and MCNG 55685, 2, 83.8–96.9, same data as holotype; AUM 41561, 1 (not measured), 41.1, Río Manapiare, at Laja Pelada landing, 27 km SSW of San Juan de Manapiare, Río Ventuari basin, 05°07'27"N, 66°05'48"W, O. Leon, D.C. Werneke, and N.K. Lujan, 18 April 2004; MCNG 37054, 1, 58.3, Río Manipiare, 5–6 km above mouth, Río Ventuari basin, K. Winemiller, L. Nico, S. Walsh, and A. Barbarino, 15 January 1998.

Diagnosis: *Peckoltia lineola* can be identified from all other *Peckoltia* except *P. braueri, P. caenosa, P. cavatica,* and *P. vermiculata* by having vermiculations on the head and snout. *Peckoltia lineola* can be identified from *P. braueri, P. cavatica,* and *P. vermiculata* by having thick vermiculations almost as wide as the pupil on the compound pterotics and snout (vs. thin vermiculations much narrower than the pupil diameter and by also having large spots on the compound pterotics and snout (vs. no spots); from *P. braueri* and *P. cavatica* by lacking an orange band in the dorsal fin; from *P. cavatica* by having the vermiculations cross the bones like the compound pterotic (vs. dark lines only outlining the plates and bones of the head); from *P. caenosa* by having dark bands in the fins (vs. light spots), by having long, thick, longitudinal lines on the abdomen (vs. vermiculations with a random orientation), by having the light interspaces on the snout of about the same width of the black spots and lines (vs. light vermiculations narrower than dark ones), and by having the light bands of the caudal at least 50% width of dark bands (vs. 25%); and from *P. vermiculata* by not having the vermiculations coming from a central point on the parieto-supraoccipital. *Peckoltia lineola* is similar to *P. brevis* except that some of the spots on the head and snout combine to form lines (vs. all spots separate) and the spots on the abdomen combine to form long, thick longitudinal lines (vs. spots separate).

Description: Morphometrics in Table 4, counts based on eight individuals unless otherwise stated. Largest specimen examined 96.9 mm SL. Body stout, fairly wide. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall, rounded crest. Parieto-supraoccipital crest barely raised above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth. Eye medium-sized.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen covered in small plates except for small naked areas posterior to lower lip and at insertions of paired fins. First anal-fin pterygiophore exposed to form a platelike struc-

ture. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 24–26 (mode 24) plates in the median series.

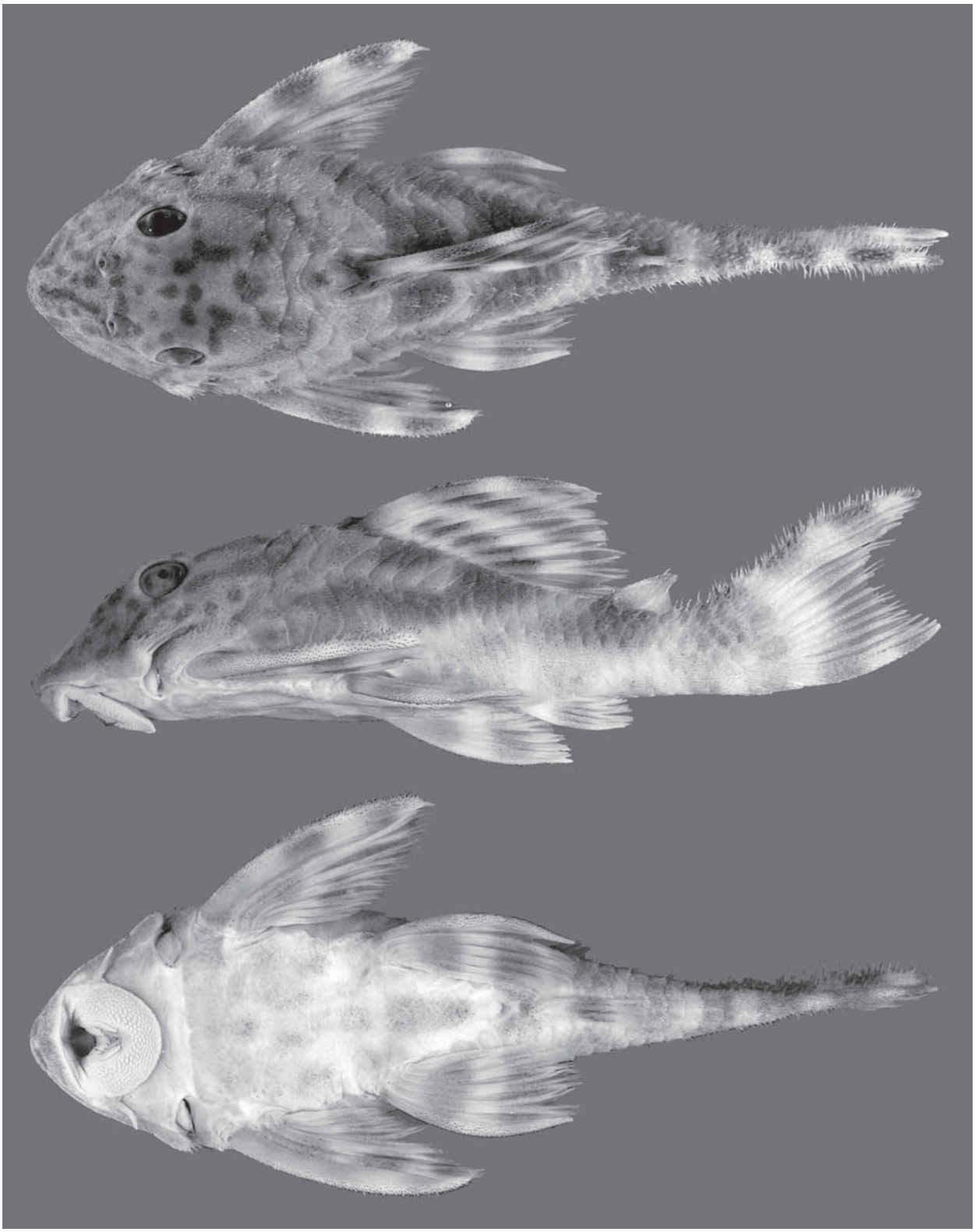

FIGURE 16. Dorsal, lateral, and ventral views of the holotype of *Peckoltia lineola* MCNG 55684, 88.1 mm SL. Photographs by J.W. Armbruster.

TABLE 4. Selected morphometrics of *Peckoltia lineola* and *P. oligospila*. Numbers in parentheses refer to landmark numbers in Armbruster (2003). Measurements are ratios of SL (predorsal l. to pelvic-dorsal l.) or head l. (head-eye l. to premaxillary tooth cup l.).

	P. lineola					*P. oligospila*				
	N	Avg.	SD	Min.	Max.	N	Avg.	SD	Min.	Max.
SL (1-20)	8	86.4	12.1	58.3	96.9	14	94.6	29.2	54.3	148.6
Predorsal L. (1-10)	8	44.1	0.8	42.7	45.0	14	42.0	1.2	38.7	43.9
Head L. (1-7)	8	36.2	0.7	35.0	37.1	14	35.0	1.4	32.7	37.1
Head-dorsal L. (7-10)	8	8.3	0.5	7.5	9.1	14	7.6	1.2	6.3	10.2
Cleithral W. (8-9)	8	28.8	2.3	26.1	31.9	14	27.5	2.2	24.7	31.4
Head-pectoral L. (1-12)	8	27.8	1.3	26.0	29.4	14	25.7	1.1	24.0	28.2
Thorax L. (12-13)	8	21.7	1.3	20.0	23.8	14	22.5	1.6	19.4	25.1
Pectoral-spine L. (12-29)	8	31.9	2.4	28.0	35.5	14	32.0	1.5	29.0	34.1
Abdominal L. (13-14)	8	22.9	1.3	20.7	24.7	14	22.7	1.1	20.8	24.0
Pelvic-spine L. (13-30)	8	25.5	1.8	23.6	28.4	14	27.4	1.6	24.7	29.5
Postanal L. (14-15)	8	32.9	1.0	31.4	34.6	14	35.7	1.2	34.3	38.8
Anal-fin spine L. (14-31)	8	13.9	0.6	12.9	14.9	14	15.0	1.2	13.3	17.5
Dorsal-pectoral D. (10-12)	8	30.0	0.8	28.9	31.1	14	29.2	0.7	28.2	30.6
Dorsal spine L. (10-11)	8	33.6	2.6	30.1	37.6	13	35.7	2.7	29.3	40.3
Dorsal-pelvic D. (10-13)	8	24.1	0.7	23.1	25.0	14	24.0	1.8	21.3	27.2
Dorsal-fin base L. (10-16)	8	27.6	0.5	26.7	28.2	14	27.7	1.4	25.3	29.5
Dorsal-adipose D. (16-17)	8	15.1	1.0	14.1	17.1	14	15.3	1.7	12.2	18.7
Adipose-spine L. (17-18)	8	9.7	1.4	7.6	11.4	14	10.8	1.8	7.7	13.1
Adipose-up. caudal D. (17-19)	8	19.0	2.5	14.9	21.9	14	18.4	1.7	15.8	21.1
Caudal peduncle Dp. (15-19)	8	12.9	1.2	10.6	14.5	14	12.6	1.5	8.0	14.9
Adipose-low. caudal D. (15-17)	8	24.2	2.4	20.7	27.4	14	24.6	1.6	21.3	26.7
Adipose-anal D. (14-17)	8	18.1	1.2	15.8	20.2	14	19.5	1.4	17.4	23.0
Dorsal-anal D. (14-16)	8	16.8	0.8	15.6	17.8	14	16.2	0.9	14.7	18.1
Pelvic-dorsal D. (13-16)	8	27.1	1.2	24.2	28.2	14	26.5	1.6	24.1	29.1
Head-eye L. (5-7)	8	36.9	0.9	35.9	38.5	14	36.2	2.1	32.4	38.8
Orbit Dia. (4-5)	8	21.6	0.8	20.3	22.7	14	19.9	1.6	17.3	23.0
Snout L. (1-4)	8	59.8	1.1	58.0	61.2	14	58.6	2.8	54.2	62.5
Internares W. (2-3)	8	14.8	1.8	12.6	18.5	14	13.6	1.2	11.2	16.1
Interorbital W. (5-6)	8	45.0	4.8	38.5	51.5	14	43.5	3.5	35.2	49.0
Head Dp. (7-12)	8	73.2	2.6	68.9	77.9	14	73.3	3.2	68.2	80.4
Mouth L. (1-24)	8	45.7	4.0	39.5	49.7	14	43.9	3.1	36.4	50.7
Mouth W. (21-22)	8	43.5	2.8	39.9	47.3	14	44.7	4.4	36.4	51.6
Maxillary barbel L. (22-23)	8	16.6	1.9	13.7	20.3	14	17.3	2.9	11.3	22.6
Dentary tooth cup L. (25-26)	8	11.2	2.1	7.4	14.0	14	12.5	2.2	8.4	16.0
Premax. tooth cup L. (27-28)	8	10.2	1.6	8.0	11.8	14	12.3	1.7	9.7	14.5

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 19–26 (N=5), longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with four to five (mode four) dorsal procurrent caudal-fin rays and four to five (mode five) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and approximately same length of first branched ray. Anal fin I,4, Pectoral-fin spine almost reaching just beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming very acute angle, premaxillaries forming angle of 90° to slightly greater than 90°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; 10–16 dentary teeth (N=6, mode 13), 10–19 premaxillary teeth (N=6, mode 12).

Color: Base color light tan with brown to black markings. Four dorsal saddles on the body, the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth at the end of the caudal peduncle. Third and fourth bars may have anterior extensions or have an anterior projection making them *h*-shaped. Fourth bar combines with first band of caudal dorsally. The first two saddles combine midbody. All fins with dark bands with dark and light areas ranging from approximately equal width to dark bands wider, caudal bands may be irregular. Number of bands increases with size. Dark spot present between dorsal-fin spinelet and spine. Abdomen with large spots that combine to form thick longitudinal lines (usually one almost continuous central line and lines on each side). Lower surface of caudal peduncle with dark blotches formed from the lower extensions of the third and fourth dorsal saddle, the anterior extensions of the third and fourth saddles, and accessory blotch between the third and fourth saddles. Juveniles colored as adults, but without anterior extensions of the third and fourth dorsal saddles, without spots on the abdomen, and with the spots and lines on the head less numerous.

Sexual Dimorphism: The main collection consists of only nuptial males. Nuptial males with hypertrophied odontodes on sides and posterior part of head; hypertrophied odontodes becoming larger posteriorly. Hypertrophied odontodes on upper caudal-fin spine and adipose spine. Upper caudal-fin spine thickened. Odontodes on pectoral-fin spine not noticeably larger.

Range. Known from the Río Ventuari of Venezuela and the Río Iniridá of Colombia (Fig. 8).

Habitat. Specimens collected in Venezuela were from rocky riffles.

Etymology: *Lineola* is Latin for little line, refers to the short lines on the compound pterotic.

***Peckoltia multispinis* (Holly, 1929)**
(Fig. 17)

Ancistrus multispinis Holly, 1929: 119. Type locality: Mercado Bléin (Brasilien). Holotype: NMW 8952.

FIGURE 17. Dorsal, lateral, and ventral vies of the holotype of *Ancistrus multispinis* NMW 8952, 115.2 mm SL. Photographs by M.H. Sabaj and K. Luckenbill.

Comments: The type of *Ancistrus multispinis* had been lost for a long time until Mark Sabaj rediscovered it in 2007. The species had been considered a *Lasiancistrus* since Isbrücker (1980). Armbruster (2005) recognized that the original description was not entirely consistent with a *Lasiancistrus*, but placed the species into the synonymy of *L. schomburgkii* anyway. The label was clearly misread by Holly as it does say ÒMercado BelémÓ (Fig. 17). The species is most certainly a species of *Peckoltia*, but I have only examined photos provided by Mark Sabaj and Kyle Luckenbill. The species is relatively unique in that it has the lower lip consisting of short, multibranched fimbriae; however, some *P. vittata* approach the condition in *P. multispinis*. The only color remaining is some faint, irregular banding in the caudal fin that is consistent with most species of *Peckoltia*, including *P. vittata*, which is known from around Belém. The species may be valid or a synonym of *P. vittata*. I tentatively recognize it as valid, but with the color gone from the type specimen and little pertinent information in the original description, it is impossible to compare the species with other *Peckoltia*, and it is not included in diagnoses or the key.

***Peckoltia oligospila* (Günther 1864)**
(Fig. 18–19)

Chaetostomus oligospilus Günther, 1864: 244. Type locality: River Capin [Brazil]. Holotype: BMNH 1849.11.8, illustrated in Regan (1904b: 232, pl. 12 fig. 1).

Material Examined: All Collections BRAZIL, Pará, Rio Tocantins – Atlantic Ocean drainage: BMNH 1849.11.8, Holotype, 1, 87.2, Rio Capim; INPA 6321, 1, 148.6, Rio Tocantins, Igarapé Jatobal, Equipe Ictilogia do INPA, 17 July 1981; MCP 14535, 5, 54.3–70.0, Rio Tocantins in the city of Cametá, M.T.C. Lacerda, 1988; MCP 21967, 1, 101.7, Rio Guamá in Urucuritéua on the road between São Miguel do Guamá and Ourém, Rio Capim basin, 01°35’28”S, 047°20’18”W, R. Reis, J. P. Silva, E. Pereira, J. Montoya, 22 July 1998; MCP 21970, Rio Jauara on the Belém/Brasília Road (BR 010) between Mãe do Rio and Irituia, Rio Capim basin, 01°55’29”S, 047°31’21”W, R .Reis, J. P. Silva, E. Pereira, J. Montoya, 19 July 1998; MCP 21971, 5, 93.4–104.2, Rio Guamá near Ourém, Rio Capim basin, 01°35’28”S, 047°20’18”W; MCZ 62116, 1, 136.1, Río Apeu at Boa Vista, Rio Capim basin, 01°18’S, 047°59’W, N.A. Menezes, July 1965; MZUSP 23872, 1, 83.6, Rio Capim, close to Caranan déua, EPA, 16–17 August 1970; MZUSP 53398, 1, 135.7, Igarapé Apeú, Boa Vista, 01°18’S, 047°58’W, P.E. Vanzolini, 3–4 February 1964; NMW 48065, 1, 111.8, Pará, Brasilien Expedition, 1903.

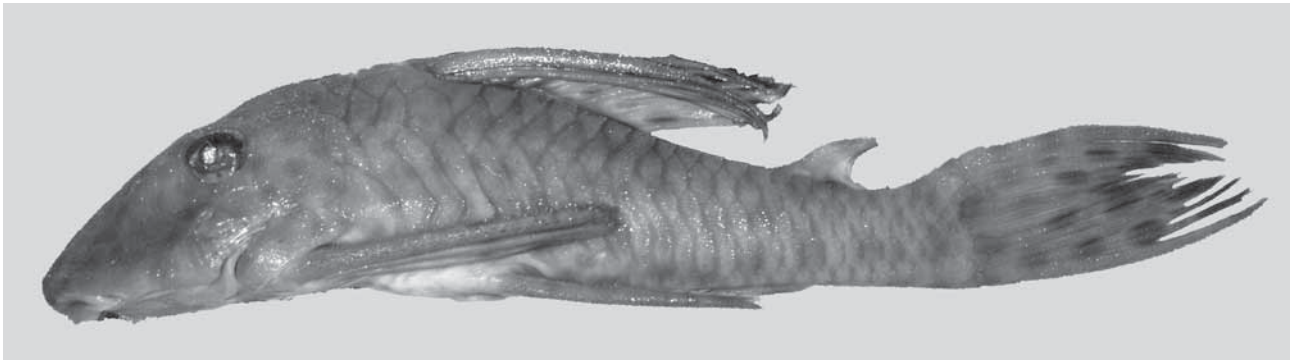

FIGURE 18. Lateral view of holotype of *Chaetostomus oligospilus*, BMNH 1849.11.8, 87.2 mm SL. Photograph by J.W. Armbruster.

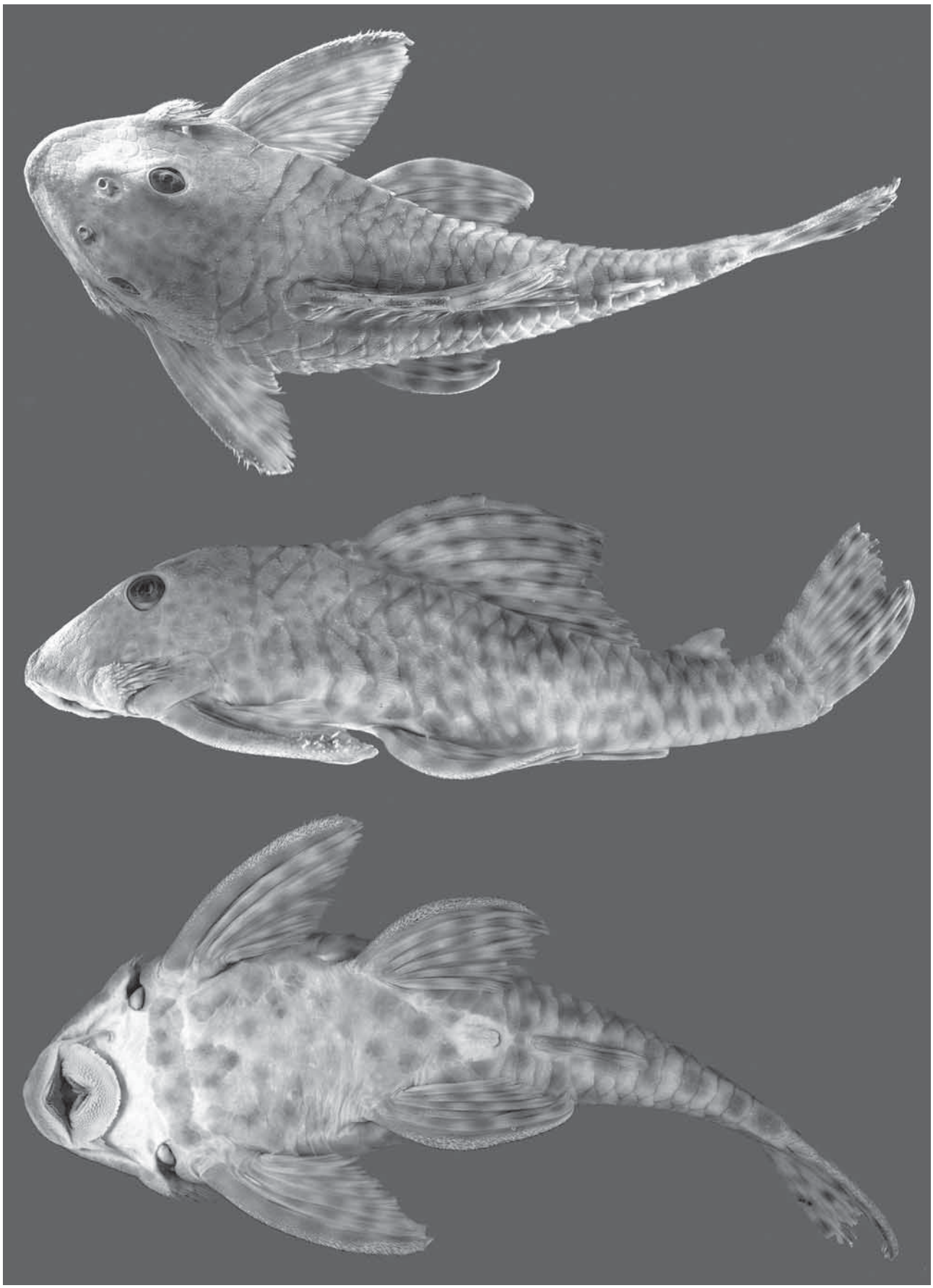

FIGURE 19. Dorsal, lateral, and ventral views of *Peckoltia oligospila*, MCZ 62116, 136.1 mm SL. Photographs by J.W. Armbruster.

Diagnosis: *Peckoltia oligospila* can be identified from all other *Peckoltia* except *P. bachi* and some *P. furcata* by having spots on the body and the saddles faint; from *P. bachi* by having narrow pelvic-fin spines (vs. wide), the eye high on the head (vs. low), and by having the spots distinctly round (vs. appearing more as a mottling); and from *P. furcata* by having spots on the abdomen of larger juveniles and adults (vs. spots on abdomen always absent) and by having the spots separate in the caudal fin (vs. combining to form bands). *Peckoltia lineola* also has spots on the head. *Peckoltia oligospila* can be further separated from *P. lineola* by having spots in all fins (vs. bands in all fins) and by having none of the spots on the head combining to form vermiculations.

Description. Morphometrics in Table 4, counts based on 17 individuals unless otherwise stated. Largest specimen examined 148.6 mm SL. Body stout and fairly wide. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall crest. Parieto-supraoccipital crest raised well above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth except parieto-supraoccipital crest. Eye medium-sized.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen largely naked with a column of plates below pectoral girdle, rows of plates laterally, a patch of plates in front of the anus, and occasionally a small patch of plates medially just posterior to pectoral girdle. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 24–26 (mode 26) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 13–50 (N=16), longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, not reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with three to five (mode five) dorsal procurrent caudal-fin rays and two to four (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and about same length of first branched ray. Anal fin I,4, Pectoral-fin spine reaching just beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming very acute angle, premaxillaries forming gentle arc less than 135°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; eight to 25 dentary teeth (mode 15), 16–30 premaxillary teeth (mode 20).

Color: Base tan with brown markings. Head with small to medium faint spots slowly becoming larger posteriorly, none of the spots intense. Body with four faint dorsal saddles, the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth at the end of the caudal peduncle. The first two saddles combine midbody or may fuse completely. Dorsal fin with very large, round spots not arranged in distinct rows. Spots in other fins arranged roughly into rows, but usually not fusing to form bands. In all fins, the light inter-

spaces are as wide or wider than the spots. Abdomen usually with medium spots. Ventral surface of caudal peduncle with a single, medial row of spots. Juveniles with much larger spots that contrast much better with lighter areas, no spots on abdomen.

Sexual Dimorphism: None observed, but even on the specimens available, the odontodes on pectoral-fin spine noticeably larger.

Range. Known from the Rios Tocantins and Capim drainages of eastern Brazil (Fig. 5).

***Peckoltia vermiculata* (Steindachner, 1908)**
Fig. 20

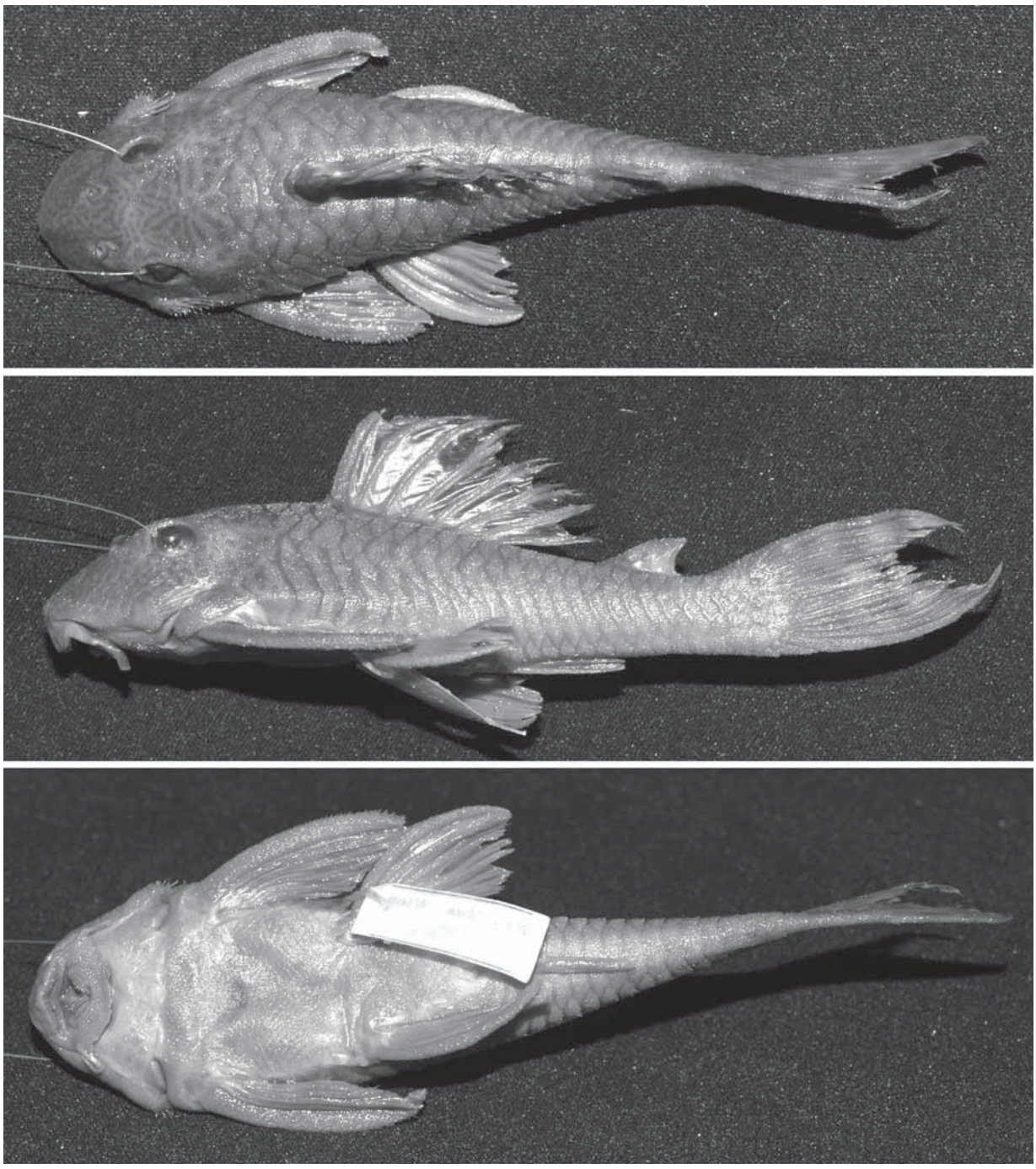

FIGURE 20. Dorsal, lateral, and ventral views of the syntype of *Peckoltia vermiculata* NMW 48056, 107.9 mm SL. Photographs by J.W. Armbruster.

Ancistrus vittatus vermiculata Steindachner, 1908: 166. Type locality: dem mittleren Laufe des Amazonestrommes, den Gewässern um Pará, Brasiliens. Syntypes: NMW 48056 (1), NMW 48059 (1), NMW 48064 (1). Originally as *Ancistrus vittatus* var. *vermiculata*.

Material Examined: All syntypes, BRAZIL, Pará, no other locality information available: NMW 48056, 1, 107.9; NMW 48059, 1, 74.7; NMW 48064, 1 94.9.

Diagnosis: *Peckoltia vermiculata* can be identified from all other *Peckoltia* by having vermiculate lines radiating from a central point on the parieto-supraoccipital. Other *Peckoltia* with dark vermiculations on the head are *P. braueri, P. caenosa*, *P. cavatica,* and *P. lineola*, none of which have the vermiculations radiating from a central point. *Peckoltia vermiculata* can be further separated from *P. braueri* by lacking vermiculations on the compound pterotic; from *P. cavatica* by having markings across the bones and plates of the head (vs. just outlining the bones and plates); from *P. caenosa* by lacking markings on the abdomen (vs. having vermiculations), and by having dark bands at least on the caudal fin (vs. small white spots); and from *P. lineola* by having the vermiculations narrower than the pupil (vs. wider than the pupil) and by lacking spots on the abdomen (vs. spots combining to form longitudinal lines).

Description. Morphometrics in Table 5, counts based on three individuals. Largest specimen examined 107.9 mm SL. Body stout, fairly wide. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall, rounded crest. Parieto-supraoccipital crest barely raised above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth. Eye medium-sized.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen covered in small plates except for small naked areas posterior to lower lip and at insertions of paired fins. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 25–26 (mode 26) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 28–35, longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with five dorsal procurrent caudal-fin rays and four to five (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and approximately same length of first branched ray. Anal fin I,4, Pectoral-fin spine reaching just beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming acute angle, premaxillaries forming gentle arc less than 135°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; seven to 10 dentary teeth (no mode available), nine premaxillary teeth.

TABLE 5. Selected morphometrics of *Peckoltia vermiculata* and *P. vittata*. Numbers in parentheses refer to landmark numbers in Armbruster (2003). Measurements are ratios of SL (predorsal l. to pelvic-dorsal l.) or head l. (head-eye l. to premaxillary tooth cup l.).

	P. vermiculata					*P. vittata*				
	N	Avg.	SD	Min.	Max.	N	Avg.	SD	Min.	Max.
SL (1-20)	3	92.5	16.8	74.7	107.9	128	77.8	15.2	44.6	113
Predorsal L. (1-10)	3	40.6	0.4	40.2	41.1	128	43.7	2.1	38.9	51.0
Head L. (1-7)	3	33.9	0.8	33.3	34.8	128	36.6	1.7	32.5	42.7
Head-dorsal L. (7-10)	3	7.0	0.7	6.6	7.9	126	7.3	1.3	3.8	10.3
Cleithral W. (8-9)	3	29.1	0.3	28.9	29.5	128	30.6	2.1	25.6	35.7
Head-pectoral L. (1-12)	3	26.3	1.0	25.5	27.4	128	28.0	1.2	24.7	31.5
Thorax L. (12-13)	3	23.3	1.8	21.2	24.7	128	23.0	1.8	17.5	28.4
Pectoral-spine L. (12-29)	3	29.1	0.5	28.6	29.7	128	31.9	1.8	27.1	36
Abdominal L. (13-14)	3	21.0	0.9	20.5	22.1	128	22.9	1.7	19.2	26.6
Pelvic-spine L. (13-30)	3	24.1	1.5	22.4	25.4	157	26.8	1.6	17.9	31.0
Postanal L. (14-15)	3	34.5	0.9	33.9	35.6	128	33.3	2.1	27.3	38.1
Anal-fin spine L. (14-31)	3	15.4	0.9	14.5	16.2	128	15.5	1.4	11.3	19.5
Dorsal-pectoral D. (10-12)	3	28.1	0.1	27.9	28.2	128	29.3	1.9	23.8	33.3
Dorsal spine L. (10-11)	2	32.0	0.7	31.6	32.5	107	33.8	2.5	27.1	40.3
Dorsal-pelvic D. (10-13)	3	24.5	0.8	23.8	25.4	127	25.2	2.6	18.8	31.0
Dorsal-fin base L. (10-16)	3	25.9	1.4	24.9	27.5	128	27.7	1.5	23.2	31.0
Dorsal-adipose D. (16-17)	3	16.4	0.8	15.5	16.9	128	15.6	1.9	8.4	19.9
Adipose-spine L. (17-18)	3	9.4	0.2	9.2	9.6	128	10.2	1.3	7.6	13.6
Adipose-up. caudal D. (17-19)	3	16.0	0.9	15.3	17.0	128	16.9	2.0	13.3	23.5
Caudal peduncle Dp. (15-19)	3	11.8	0.3	11.6	12.1	128	12.7	1.1	10.4	15.5
Adipose-low. caudal D. (15-17)	3	23.1	0.3	22.9	23.5	128	23.2	1.6	19.2	27.6
Adipose-anal D. (14-17)	3	20.0	0.8	19.1	20.6	128	20.0	1.4	15.9	23.3
Dorsal-anal D. (14-16)	3	16.9	1.1	16.1	18.2	128	17.0	1.6	14.2	21.4
Pelvic-dorsal D. (13-16)	3	25.5	0.9	24.8	26.5	128	26.2	2.9	19.2	31.9
Head-eye L. (5-7)	3	38.1	1.0	37.0	39.0	123	37.5	2.6	32.1	55.1
Orbit Dia. (4-5)	3	21.1	0.9	20.2	21.8	128	20.6	1.9	13.6	25.3
Snout L. (1-4)	3	59.4	3.1	55.9	61.8	128	58.1	2.6	52.3	64.5
Internares W. (2-3)	3	15.6	0.8	14.9	16.4	128	14.5	2.5	9.1	20.9
Interorbital W. (5-6)	3	40.3	1.9	38.2	41.8	123	45.8	5.1	32.1	56.4
Head Dp. (7-12)	3	73.5	2.6	70.5	75.6	128	71.4	4.1	63.5	87.7
Mouth L. (1-24)	3	41.2	3.4	37.7	44.3	128	45.3	3.8	37.1	55.6
Mouth W. (21-22)	3	41.4	1.5	40.1	43.1	128	43.9	3.7	36.0	54.7
Maxillary barbel L. (22-23)	3	19.4	5.4	13.7	24.5	128	16.7	3.0	6.8	24.5
Dentary tooth cup L. (25-26)	3	11.2	0.4	10.7	11.5	126	12.4	2.4	7.3	19.0
Premax. tooth cup L. (27-28)	3	12.1	0.8	11.2	12.7	127	12.6	2.2	8.7	19.3

Color: Color of all specimens faded. Base color light tan with slightly darker markings. Four dorsal saddles weakly evident on body, the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth

at the end of the caudal peduncle. The first two saddles might combine midbody. Anterior body plates may have been outlined with darker pigment. Head with short, dark lines radiating from central point on parieto-supraoccipital, lines narrower than pupil diameter; snout with small spots or spots combining to form network of vermiculations; spots mostly separate below eye and on compound pterotic, dorsal process of cleithrum, and first column of lateral plates. Dorsal and pectoral fins dark, pelvic fins with faint bands, caudal with 3–5 bands. Abdomen without markings. Lower surface of caudal peduncle tan.

Sexual Dimorphism: None observed.

Range. Locality only given as Pará, Brazil.

***Peckoltia vittata* (Steindachner, 1881)**
(Figs. 2f and 21–22)

Chaetostomus vittatus Steindachner, 1881: 115, pl. 2 (fig. 5). Type locality: Amazonen-Strom, Tajapouru, Xingu bei Porto de Moz, Rio Madeira [Brazil]. Syntypes: MCZ 7999 (1), MCZ 8017 (1), NMW 47225 (1), NMW 47226 (1), NMW 47227 (1), NMW 47228 (2).

Peckoltichthys kuhlmanni Miranda Ribeiro, 1920: 10, pl. 5 (middle). Type locality: Tapajóz [Brazil]. Lectotype: MNRJ 2044A, designated by Miranda Ribeiro (1953: 401), but specimen not isolated.

FIGURE 21. Lateral views of types of species assigned to *Peckoltia vittata*, A. syntype of *Peckoltichthys kuhlmanni* MNRJ 2044, 90.8 mm SL and B. syntype of *Chaetostomus vittatus*, NMW 47228, 91.1 mm SL. Photographs by J.W. Armbruster.

Material Examined: BOLIVIA, unknown state, Río Madeira - Río Amazonas drainage: FMNH 59718, 4, 89.9–100.2, San Joaquin, J.D. Haseman, 6 September 1909. BOLIVIA, Beni, Río Madeira - Río Amazonas drainage: USNM 305554, Ballivia Province, Rio Curiraba at 10 km NE El Porvenir Biol. Sta., at 40 Air Km E San Borja., 14°55'S, 066°17'W, W.C. Starnes, T. Munroe, and J. Sarmiento, 28 August 1987. BOLIVIA,

Pando, Río Madeira - Río Amazonas drainage: FMNH 107073, 2, 69.5–71.6, Nareuda rapids, +/- 6 km from the mouth of the Tahuamanu, 11°18'18"S, 068°45'25"W, J. Sarmiento, H. Ortega, S. Barrera, and F. Yapur, 11 September 1996; FMNH 107074, 1, 85.2, a small rapids in Río Tahuamanu just above Boca Nareuda, 0.44 km above, 11°18'51"S, 068°44'35"W, H. Ortega, B. Chernoff, N. Menezes, T. Bert, and R. Coca, 12 September 1996.

BRAZIL, unknown locality: CU 76567, 1, 107.3. BRAZIL, Amapá, Rio Amazonas drainage: MNRJ 20973, 10, 73.6–104.3, Queimada, near Mazangão, G.W. Nunan, D.F. Moraes, and W.D. Bandeira, April 1981; MNRJ 20990, 1, 71.0, Rio Miri, near Mazagão-Macapá, G.W. Nunan and D.F. Moraes Jr., April 1981. BRAZIL, Amazonas, Rio Amazonas drainage: INPA 4741, 1, 113.0, Rio Uatumã, S. Amadio, 1 April 1985. BRAZIL, Pará, Rio Amazonas drainage: CAS 6476, 1 cs, Belem fish market, C. Ternetz, April 1924; FMNH 59717, 3, 53.1–91.5, Pará, J.D. Haseman, 15 January 1910; FMNH 70113, 1, Rio Tapajos, Pindobal, H. Sioli, 28 October 1947; INPA 11143, 3, 84.0–89.6, Rio Tocantins, Itupiranga, Equipe Ictilogia do INPA, 1 November 1980; INPA 4028, 1, 86.8, Rio Xingu, Altamira province, L. Rapp Py-Daniel & J. A. Zuanon, 1 October 1990; INPA 4029, 1, 68.1, Rio Xingu, Cachoeira de Kaituka, L. Rapp Py-Daniel & J. A. Zuanon, 10 October 1990; INPA 5726, Rio Trombetas, Porto Trombetas, E. G. Ferreira & J. A. Zuanon, 30 August 1990; INPA 6315, 3, 93.4–112.0, Rio Tocantins, Acari-pucu, Equipe Ictilogia do INPA, 30 January 1985; INPA 6326, 3, 88.2–93.8, Rio Tocantins, Breu Branco, 05°04'04"S, 049°38'13"W, Equipe Ictilogia do INPA, 13 July 1982; INPA 6337, 2, 45.9–100.4, Rio Tocantins, 50 km above the dam, Equipe Ictilogia do INPA, 30 January 1985; INPA 7274, 1, 75.6, Rio Tapajos, Ilha da Pedra in the village Vila de Bui, L.Rapp Py-Daniel & J. A. Zuanon, 28 October 1991; MCP 30027, 4, 57.7–68.0, Rio Tapajós, left margin, 04°17'S, 055°59'W, J. G. de Frota & M. L. de Sousa Abreu, 29 July 2002; MNRJ 2044, 2, Syntypes of *Peckoltia kuhlmanni,* Rio Tapajos, G. Kuhlmann, November 1915; MNRJ 19374, 3, 44.6–51.8, Rio Tocantins near Tucuruí, L.C. Alvarenga; MZUSP 23988, 1, 100.3, Igarapé Sororoca, Furo de Panaquera, 07°50'S, 049°07'W, EPA, 31 August 1970; MZUSP 23999, 6, 85.3–103.0, Igarapé Inó, Furo de Panaquera, EPA, 1 September 1970; MZUSP 24122, 6, 68.1–77.3, Lagoon near Jatobal, Rio Tocantins, 04°32'S, 049°32'W, Expedicão Permanente à Amazônia, 16 September 1970; MZUSP 34188, 0, 41.6, Rio Tapajos, Pederneiras, near the Itaituba, poço de pedral, 04°12'S, 055°10'W, M. Goulding, 24 October 1983; MZUSP 34189, 1, 78.7, Rio Tapajós, near Alter do Chão, M. Goulding, 25 November 1983; MZUSP 34190, 5, 64.2–86.4, Rio Tapajos, São Luis, above the Itaituba, 04°12'S, 055°50'W, M. Goulding, 22 October 1983; MZUSP 3590, 5, 79.3–86.1, Santarém; MZUSP 61995, 1, 102.4, Rio Tocantins, from immediately below to ca. three km below of the spillway of the reservoir, 03°42'S, 049°27'W, Equipe CPA-Eletronorte and F.C.T. Lima, 17 May 2000; MZUSP 75226, 1, 83.6, Bank of Ilha das Araras, Curralinho, Rio Para, R.B. Barthem, 24 July 1984; NMW 46360, 3, 95.0–99.8, Pará, Brasilien Expedition; NMW 46361, 1, 93.3, Pará, Brasilien Expedition; NMW 47228, Syntype, 2, 58.1–91.1, Tajapuru, Thayer Expedition, January 1874; NMW 48055, 1, 51.3, Santarem, J.D. Haseman; NMW 48057, 1, 57.6, Pará, Brasilien Expedition; NMW 48058, 1, 83.4, Pará, Brasilien Expedition; NMW 48060, 1, 98.0, Pará, Brasilien Expedition; NMW 48061, 1, 95.1, Pará, Brasilien Expedition; NMW 48062, 1, 89.4, Pará, Brasilien Expedition; Rio Amazonas, NMW 48063, 1, 71.6, Rio Tapajos, Villa Braga, Museum Goldi, Snethlage; USNM 52593, 2, 98.1–99.2, Pará to Manaus, Rio Amazonas, J.B. Steere, 1901. BRAZIL, Rondônia, Rio Madeira - Rio Amazonas drainage: INPA 11135, 1, 69.0, Rio Machado 20 km below Ji-Paraná, Equipe Ictiologia do INPA, 4 June 1984; MCP 35634, 10, 65.8–73.6, Rio Machado upstream of bridge to Ji-Paraná, 10°53'S, 067°56'21"W, 15 July 2004; MNRJ 15619, 2, 76.7–77.9, Rio Urupá (tributary of the Rio Machado), Gleba G, linha 24 (between Ouro Preto do Oeste and Ji-Paraná, W.D. Bandeira and G.W. Nunan, 15 July 1986; UF 100630, 1, 74.8, Jamari River, ca 20 km downstream from Samuel dam, locally called Pedra de Santa Ana, J.P. Viana, 15 August 1993.

COLOMBIA, Meta: ICNMNH 7954, Rio Duda, tributary of Rio Guyabero - Rio Guaviare, Mesetas Veleda, San Isidro.

VENEZUELA, Amazonas, Río Orinoco drainage: AUM 39248, 1, 63.2, Río Ventuari, Moriche (beach)

116 km NE of Macuruco, 169 km NE of San Fernando de Atabapo, 04°45’09”N, 066°21’17”, D.C. Werneke, N.K. Lujan, M.H. Sabaj, L.S. de Souza, 7 April 2004; AUM 39313, 26, 2 cs, 56.8–87.3, Rio Manapiare, 14.5 km NW of San Juan de Manapiare, 05°25’43”N, 066°08’10"W, N.K. Lujan, M.H. Sabaj, L.S. de Souza, and D.C. Werneke, 12 April 2004.

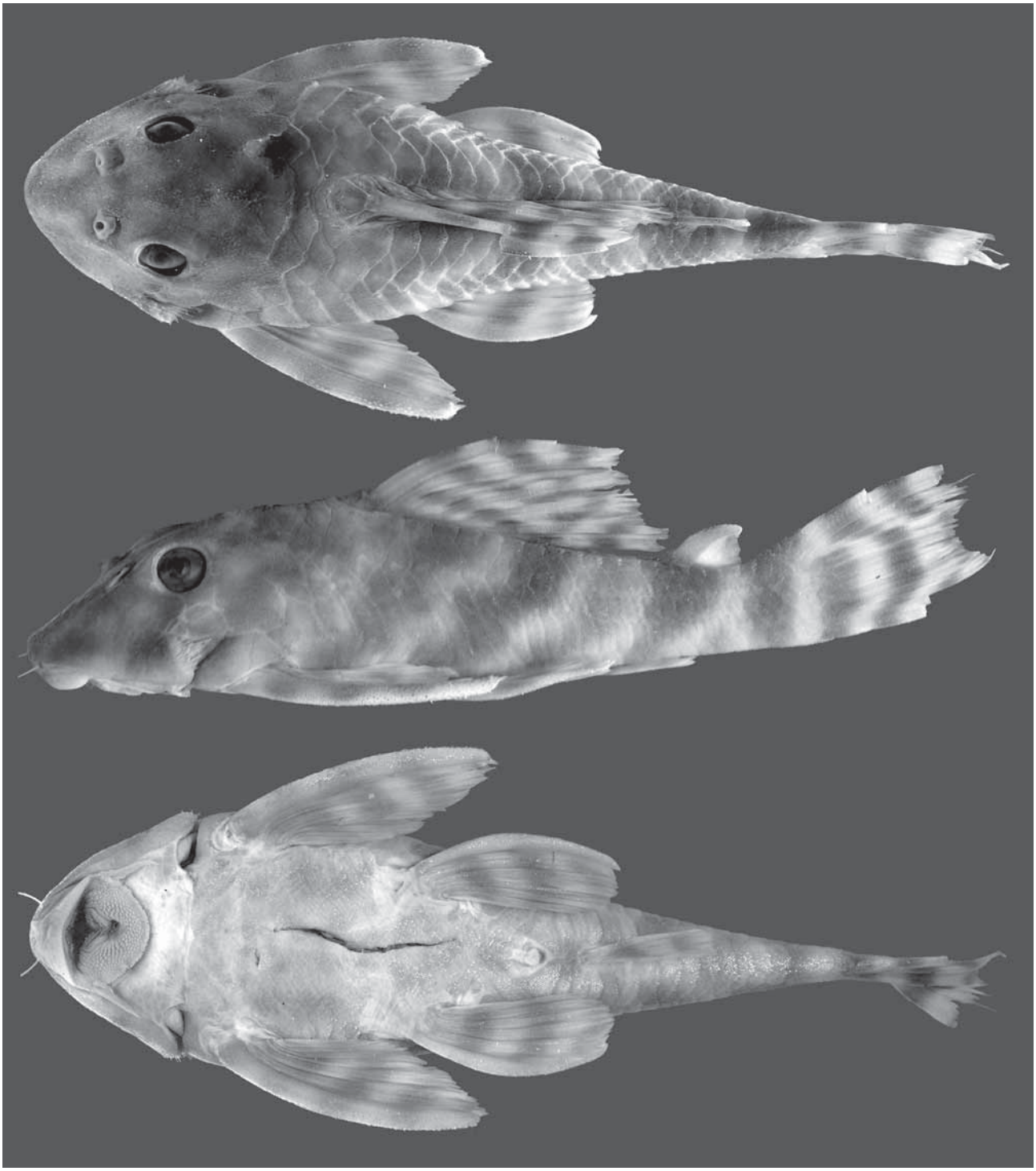

FIGURE 22. Dorsal, lateral, and ventral views of *Peckoltia vittata* NMW 48063, 71.6 mm SL. Photographs by J.W. Armbruster.

Diagnosis: *Peckoltia vittata* can be identified from all other *Peckoltia* by having the dorsal color of the head with a wedge of dark pigment on the snout and a bar from the posterior edge of the frontal to just behind

the parieto-supraoccipital (the pigment may alternatively appear as dark mottling and/or the anterior marking may appear, particularly in juveniles, in the form of a dark *E* on the snout). All other *Peckoltia* either have spots or vermiculations on the head, or the head plates and bones outlined in black.

Description. Morphometrics in Table 5, counts based on 155 individuals unless otherwise stated. Largest specimen examined 113.0 mm SL. Body stout but slightly narrower in appearance than other *Peckoltia*. Head gently sloped to parieto-supraoccipital. Parieto-supraoccipital with tall, rounded crest. Parieto-supraoccipital crest raised slightly above nuchal region. Nuchal region rises slightly to nuchal plate. Dorsal profile sloped ventrally to dorsal procurrent caudal-fin spines, then rising rapidly to caudal fin. Ventral profile flat to ventral procurrent caudal-fin spines and then sloping ventrally to caudal fin. Supraorbital ridge rounded, contiguous, but slightly offset medially from rounded ridge proceeding from anterior margin of orbit to anterolateral corner of anterior nare. Head contours smooth. Eye medium-sized.

Keels absent. Mid-ventral plates bent at their midline above pectoral fin to form ridge. Dorsal plates bent dorsally below dorsal fin to form ridges that converge at preadipose plate, dorsal surface flat between ridges. Five rows of plates on caudal peduncle. Abdomen ranging from naked to fully covered in small plates except for small naked areas posterior to lower lip and at insertions of paired fins. First anal-fin pterygiophore exposed to form a platelike structure. A pair of lateral plates converging at midline between anus and exposed first anal-fin pterygiophore. 22–26 (mode 24) plates in the median series.

Frontal, infraorbitals, nasal, compound pterotic, sphenotic, and parieto-supraoccipital, supporting odontodes; opercle supporting odontodes in juveniles but not in adults, posterodorsal corner of opercle covered by one or two plates in adults. Odontodes on lateral plates not enlarged to form keels. Hypertrophied cheek odontodes 13–57 (N=101), longest almost reaching first mid-ventral plate in adults. Cheek plates evertible to approximately 90° from head. Odontodes on tip of pectoral-fin spine slightly hypertrophied.

Dorsal fin short, reaching preadipose plate fin when adpressed; dorsal-fin spine same length as proceeding rays making edge straight. Dorsal-fin spinelet *V*-shaped, dorsal-fin spine lock functional. Dorsal fin II,7. Adipose fin with one preadipose plate and fairly long spine. Caudal fin forked, lower lobe longer than upper, I,14,I with two to five (mode four) dorsal procurrent caudal-fin rays and two to five (mode four) ventral procurrent-fin rays. Anal fin short with unbranched ray weak and approximately same length of first branched ray. Anal fin I,4, Pectoral-fin spine almost reaching just beyond pelvic fin when adpressed ventral to pelvic fin. Pectoral fin I,6. Pelvic fin reaching to posterior insertion of anal-fin when adpressed. Pelvic fin I,5.

Iris operculum present. Flap between anterior and posterior nares short. Lips wide, fairly thin. Upper lip with small, round papillae. Lower lip with small papillae anteriorly and posteriorly, becoming larger medially. Maxillary barbel short, maximally reaching base of evertible cheek plates. Buccal papilla small. Jaws narrow, dentaries forming very acute angle, premaxillaries forming angle of 90° to slightly greater than 90°. Teeth with small, moderately wide cusps, lateral cusp approximately half length of medial cusp, stalk of tooth long; seven to 32 dentary teeth (mode 15), 10–35 premaxillary teeth (mode 18).

Color: Base color light tan with brown markings. Intensity of color is variable, but always consists of four dorsal saddles on the body, the first below the middle rays of the dorsal fin, the second below the posterior rays of the dorsal fin and slightly posterior, the third below the adipose fin and slightly anterior, and the fourth at the end of the caudal peduncle. The first two saddles may or may not combine at the midline. There may be secondary bars slightly lighter than the main saddles and not or barely reaching the dorsal midline between the second and third and third and fourth saddles. There may be a faint, broad stripe that covers the lower half of the sides from first to last saddle. Two additional saddles are present on the head of adults, the first forming a wedge on the snout from the tip of the snout to the anterior margins of the orbits and the second from the posterior edge of the frontal to just behind the parieto-supraoccipital; the intensity of the head saddles varies, and sometimes they appear more like mottling; occasionally, the first head saddle will appear as diffuse *E*-shaped blotch. All fins with dark bands with dark and light areas of approximately equal width, dorsal and caudal bands may be irregular; intensity of the bands varies greatly with some specimens having the

pectoral-fin and pelvic-fin bands faint. Number of bands increases with size. Dark spot present between dorsal-fin spinelet and spine. Abdomen either without spots or with large, faint spots. Lower surface of caudal peduncle mottled. Juveniles colored as adults except that the smallest individuals usually have a dark *E* on the snout (vs. a dark wedge).

Sexual Dimorphism: Few breeding males examined, and they are not fully developed. Appears to be the same as in *P. brevis*: nuptial males with hypertrophied odontodes on sides and posterior part of head; hypertrophied odontodes becoming larger posteriorly. Hypertrophied odontodes on upper caudal-fin spine and adipose spine. Upper caudal-fin spine thickened. Odontodes on pectoral-fin spine not noticeably larger.

Range. Described from the Brazilian Amazon and lower reaches of the Rio Tapajos, Rio Madeira and Xingu. Also known from the Río Ventuari of Venezuela, southern tributaries of the Amazon from the Madeira to the mouth, and the Rios Uatumã, Trombetas, Capim, and Maranhão (Fig. 11). One collection of what appears to be *Peckoltia vittata* was also identified from the upper Río Guaviare of Colombia (Fig. 11). Armbruster and Werneke (2005) suggest that the specimen pictured in Le Bail *et al.* (2000) and labeled as *Hemiancistrus aff. braueri* from the Maroni River of French Guiana could be *Peckoltia vittata*. In appearance, it is closest to *P. vittata*; however, it is difficult to discern its identity from photographs, and its color pattern seems different enough that the Maroni population may represent an undescribed species.

Habitat. Specimens collected in Venezuela were from rocks in runs.

Key to the Species of *Peckoltia* (excludes *P. multispinis*, see species description)

1 Spots present on head 2
- Color pattern on head consisting of large blotches, saddles or lines without any individual spots.....7
2 Spots on head very large, sometimes appearing as mottling; body mottled; eye set low on head with a weak supraorbital crest that is not higher than the interorbital space; pelvic-fin spines widened and can be adducted ventral to the abdominal surface of the body; plates on the abdomen rather large .... *Peckoltia bachi*
- Spots on head small; body with spots or distinct saddles; eye set high on the head with a prominent supraorbital crest that is higher than the interorbital space; pelvic-fin spines narrow and cannot be adducted ventral to the abdominal surface of the body; plates on the abdomen small.....3
3 Some of the spots combining to form lines on the parieto-supraoccipital and/or compound pterotic.....4
- None of the spots combining to form lines.....5
4 Lines on head most prominent on compound pterotic, not radiating from a central point on the parieto-supraoccipital; lines on head approximately same width or wider than pupil ..... *Peckoltia lineola*
- Lines on the head most prominent on the parieto-supraoccipital where they radiate from a central point; lines on head narrower than pupil..... *Peckoltia vermiculata*
5 Spots present on caudal fin ..... *Peckoltia oligospila*
- Bands present on caudal fin 6
6 Spots on the dorsal fin; no spots on the abdomen; upper caudal-fin spine longer than lower spine (usually the tail is broken and this character is not present)..... *Peckoltia furcata*
- Bands on the dorsal fin; spots on abdomen of large juveniles and adults; lower caudal-fin spine longer than upper ..... *Peckoltia brevis*
7 Caudal fin with dark bands much wider (approximately four or more times) than light bands; dorsal fin with white spots; abdomen with large dark spots with at least some of the spots combining to form vermiculations..... *Peckoltia caenosa*
- Caudal fin with dark and light bands of approximately equal width; dorsal fin with bands or uniformly colored; abdomen with faint dark spots, spots that do not combine to form vermiculations, or uniformly light 8

8 Dark blotch between eyes and on snout, head mottled, or a bold patch of pigment in the form of an *E* on the snout with the central branch of the *E* located mid-dorsally, the top and bottom branches located just lateral to the nares, the three branches extending anteriorly, and the main stem of the *E* running transversely centered on the nares; none of the plates of the head or nape outlined in black; dorsal and caudal fins without orange edge in life ..... *Peckoltia vittata*

- Head and snout uniformly brown or with the plates outlined in black; the posterior plates of the head and nape outlined in black; dorsal and caudal fins with an orange band at the edges in life 9

9 Vermiculations on compound pterotic; plates of head and nape not completely outlined in dark black lines; caudal fin with at least one broken band; marginal orange bands of dorsal and caudal fins narrow (Fig. 2b) ..... *Peckoltia braueri*

- No markings on compound pterotic; all bones of head and nape outlined in faint black lines; caudal fin without bands; marginal orange bands of dorsal and caudal fins wide (Fig. 2d) ..... *Peckoltia cavatica*

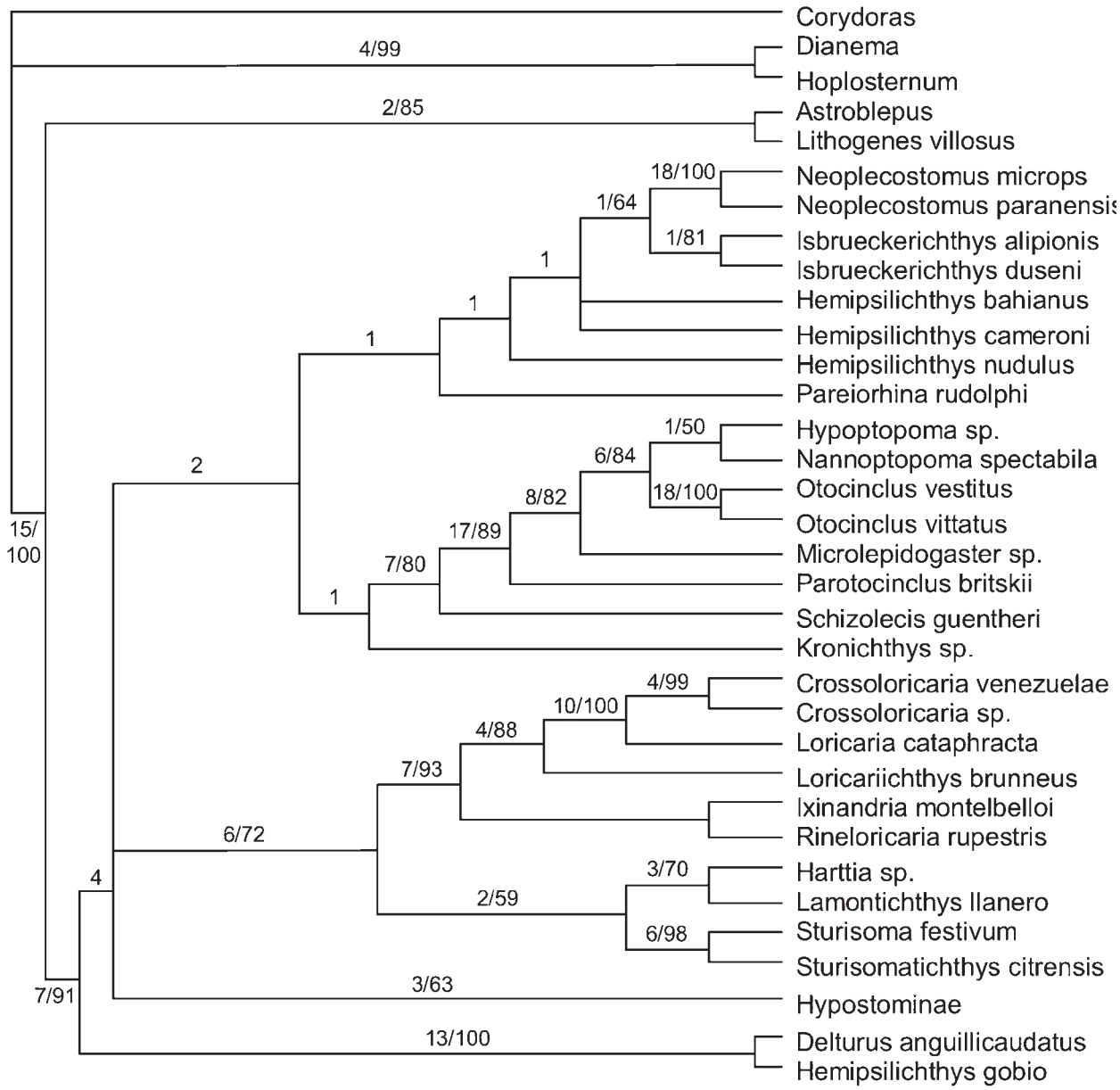

FIGURE 23. Part of the strict consensus of 1148 trees of 1388 steps, CI = 0.19, RI = 0.75 showing relationships of loricariid subfamilies. Numbers are decay indices followed by bootstrap values (when bootstrap values are greater than 50%). The remainder of the tree is in figures 24–26.

Results and Discussion

Phylogenetic Analysis

The result of the phylogenetic analysis was 1148 trees of 11388 steps, CI = 0.19, RI = 0.75 (Figs. 23–26). The phylogeny largely corresponds with Armbruster (2004) with most of the major differences being found in the Ancistrini. Outside of the Ancistrini, Armbruster (2004) had found a weak sister group relationship between the Loricariinae and the Hypostominae. This was not recovered in this analysis (Fig. 23). Using fewer taxa of *Pareiorhaphis* (formerly *Hemipsilichthys*) returned a monophyletic Neoplecostominae (although weakly supported) with the exclusion of *Kronichthys*, which was found to be the sister to the Hypoptopomatinae; these results demonstrate that the Neoplecostominae still needs further study.

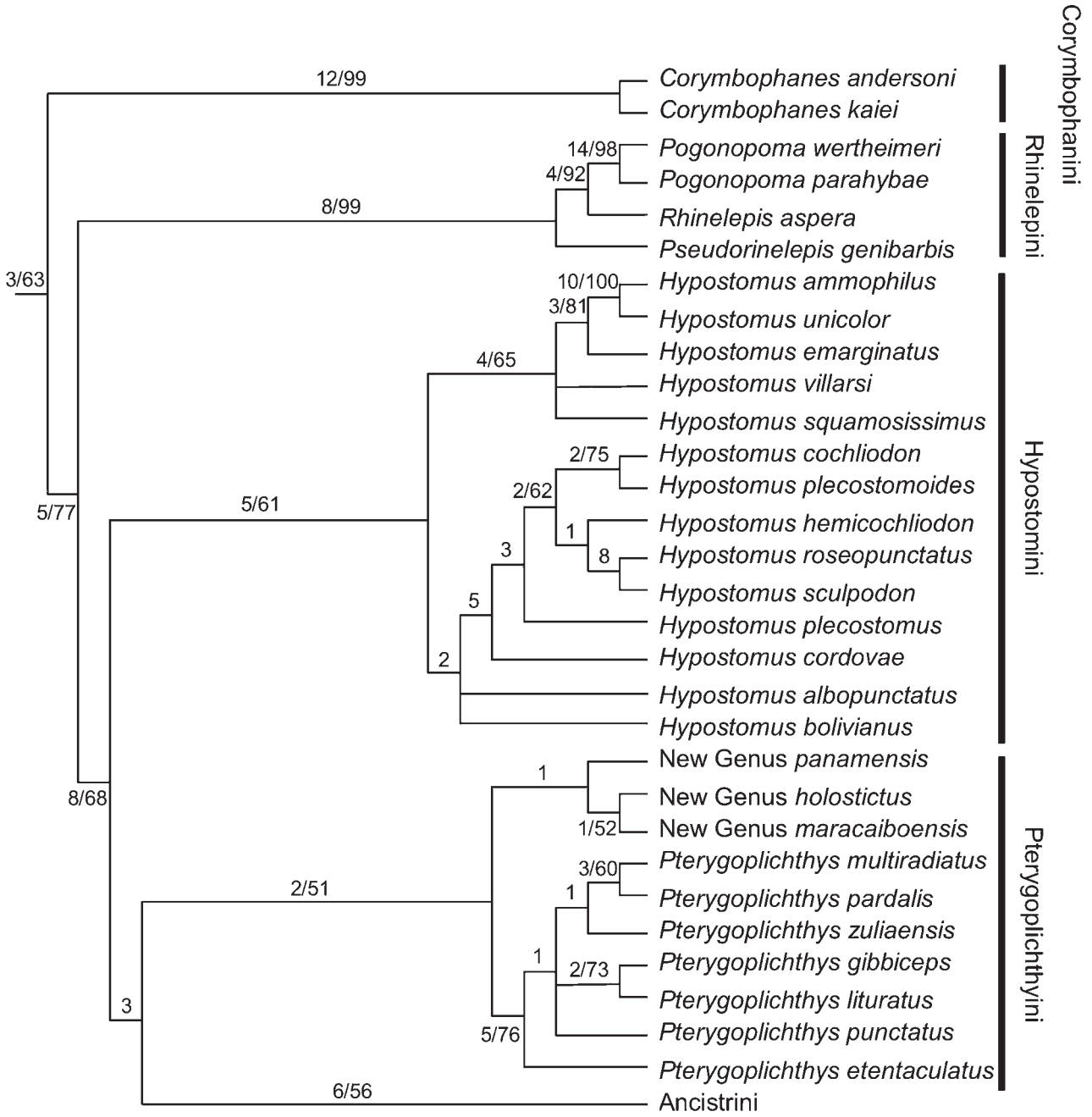

FIGURE 24. Part of the strict consensus of 1148 trees of 1388 steps, CI = 0.19, RI = 0.75 showing relationships of hypostomine tribes and the genera of the Corymbophanini, Rhinelepini, Hypostomini, and Pterygoplichthyini and the two clades of the Ancistrini. Numbers are decay indices followed by bootstrap values (when bootstrap values are greater than 50%). The remainder of the tree is in figures 23 and 25–26.

Isbrücker *et al.* (2001) described the genus *Watawata* for *Hypostomus carinatus, H. microstomus,* and *H. roseopunctatus* due to the number of teeth (16 or fewer per jaw ramus vs. 21 or greater in the remainder of *Hypostomus* except the *H. cochliodon* group) and long teeth (vs. spoon-shaped in the *H. cochliodon* group). The new analysis included *H. roseopunctatus*, and it grouped within the *H. cochliodon* group of Armbruster (2003b) supporting Weber (2003) and Armbruster (2004) in recognizing *Watawata* as a synonym of *Hypostomus* (Fig. 24). Further, the tooth count does not work as some specimens of the type species of *Hypostomus* (*H. plecostomus*) have fewer than 20 teeth (pers. obs.).

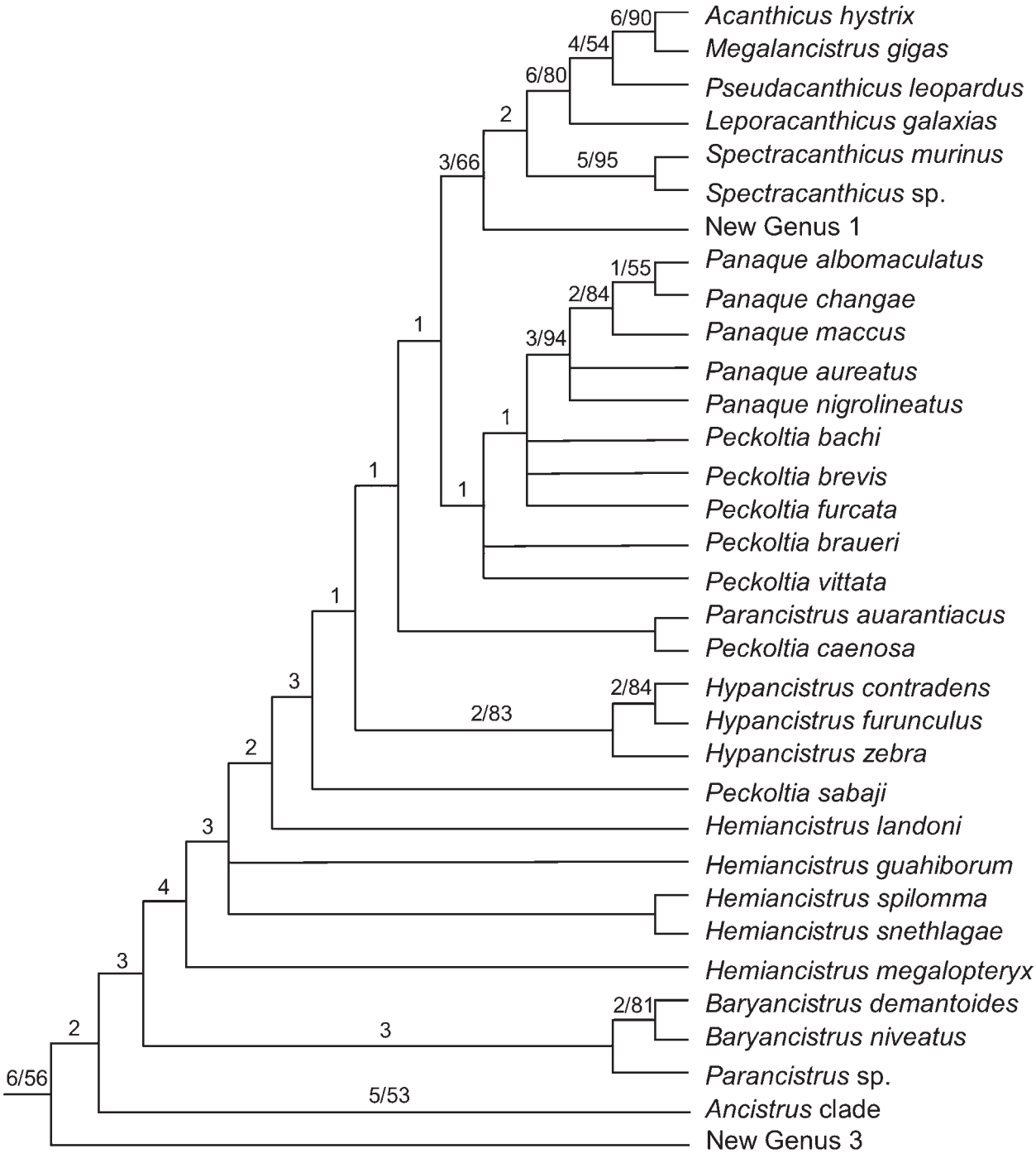

FIGURE 25. Part of the strict consensus of 1148 trees of 1388 steps, CI = 0.19, RI = 0.75 showing relationships of the *Panaque* clade of the Ancistrini. Numbers are decay indices followed by bootstrap values (when bootstrap values are greater than 50%). The remainder of the tree is in figures 23–24 and 26.

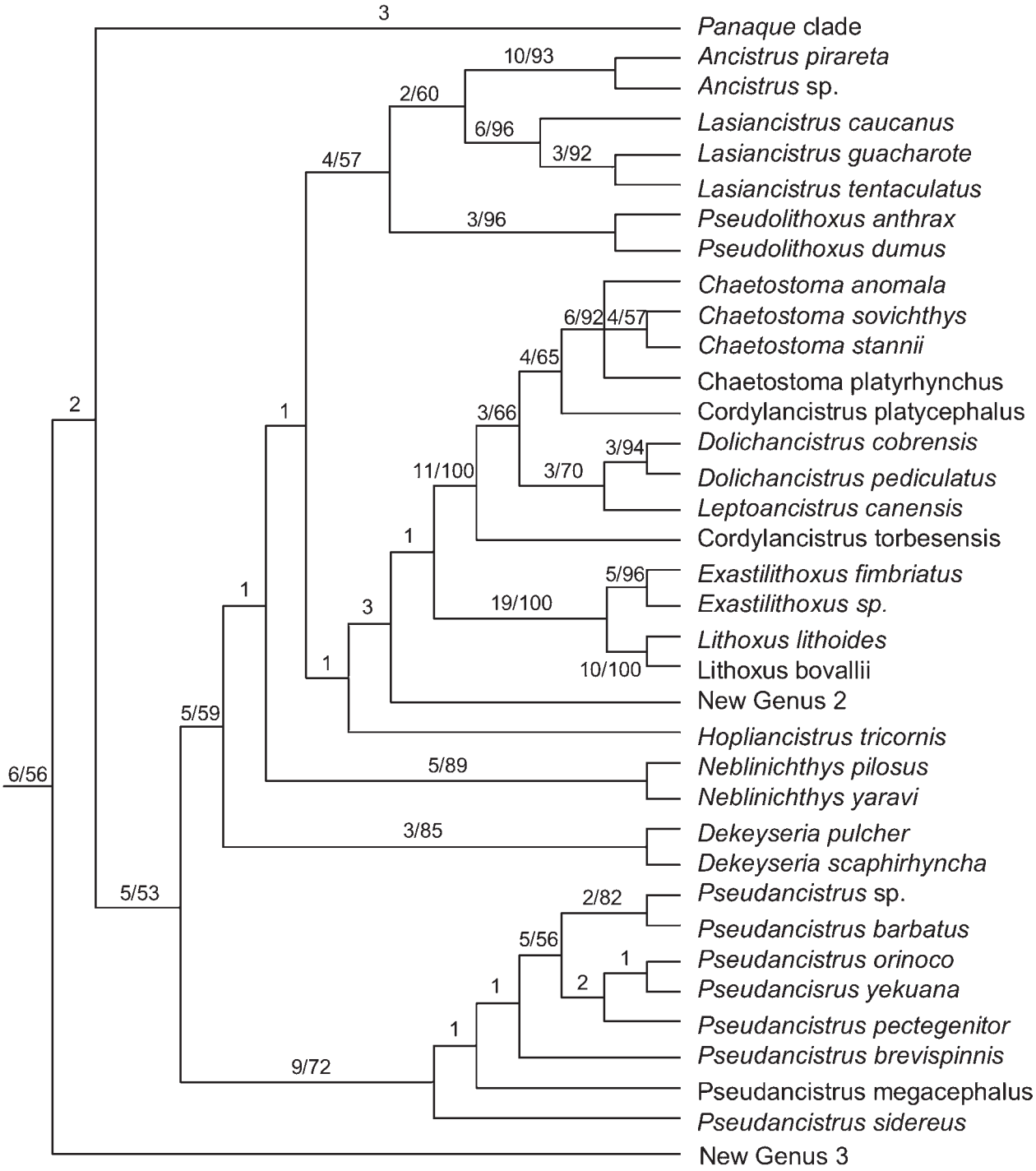

FIGURE 26. Part of the strict consensus of 1148 trees of 1388 steps, CI = 0.19, RI = 0.75 showing relationships of the *Ancistrus* clade of the Ancistrini. Numbers are decay indices followed by bootstrap values (when bootstrap values are greater than 50%). The remainder of the tree is in figures 23–25.

The Ancistrini was resolved into three clades (Figs. 25–26). The first is a single undescribed genus and species (New Genus 3) from the Marañon of Peru. This species will be discussed in a future paper. The second is termed the *Panaque* clade (Fig. 25) and is defined here as New Genus 1, *Acanthicus, Baryancistrus, Hemiancistrus*, *Hypancistrus*, *Leporacanthicus, Megalancistrus, Panaque, Peckoltia, Pseudacanthicus,* and *Spectracanthicus*. In Armbruster (2004), *Hemiancistrus megalopteryx* (as *Hemiancistrus* sp. Brazil) was the sister to all other ancistrins, and *H. landoni* was in a trichotomy with the remainder of the *Panaque* clade

minus *Baryancistrus* and the *Ancistrus* clade. In the new analysis, *Baryancistrus* is in the *Panaque* clade as it was found to lack odontodes on the opercle in adults (only juveniles were available in Armbruster, 2004). *Hemiancistrus megalopteryx* was coded as lacking the derived ancistrin opercle in Armbruster (2004); however, examination of an adult specimen reveals that it does have the derived opercle found in the *Panaque* clade and *Pseudancistrus* and that adults also lack odontodes on the opercle.

More resolution was also found in the *Ancistrus* clade (Fig. 26) due to the addition of *Hopliancistrus* (the only hypostomine genus not represented in Armbruster, 2004). *Cordylancistrus* was again found to be polyphyletic. Armbruster (2004) placed *Cordylancistrus platyrhynchus* into *Chaetostoma*, and now *Cordylancistrus platycephalus* is sister to other *Chaetostoma* while the type of the genus, *Cordylancistrus torbesensis*, is sister to all other members of the *Chaetostoma* group (*Chaetostoma, Cordylancistrus, Dolichancistrus,* and *Leptoancistrus*). *Cordylancistrus platycephalus* shares with *Chaeostoma* the derived presence of dentary papillae (a single papilla or clump of papillae located proximally on the dentary interior to the tooth cup). Given that there are others interested in the phylogeny of the *Chaetostoma* group (Salcedo, pers. comm. and Milani and Provenzano, pers. comm.), I do not make any changes to these taxa; however, the *Chaetostoma* group is a very well-diagnosed clade, but none of the genera within it are, and all species should likely be placed in *Chaetostoma* and at best subgenera should be recognized.

Defining *Peckoltia* and *Hemiancistrus*

Peckoltia and *Hemiancistrus* have been confusing for some time, and the phenetic definitions provided here make the situation only slightly better. *Hemiancistrus* is typically treated as a receptacle for unrelated forms, and neither *Peckoltia* nor *Hemiancistrus* were found to be monophyletic (Fig. 25). For the purposes of advancing the taxonomy of the genera forward, it is necessary to develop a definition for *Peckoltia* and *Hemiancistrus* at this time, and await further phylogenetic analyses that will diagnose the genera or suggest ways to split them. For that reason, I am defining *Peckoltia* phenetically as those ancistrins that have a lateral ridge on the opercle that typically does not support odontodes (although odontodes may occasionally be present in males, juveniles, and *P. bachi*) and jaws that approach or form an acute angle but that lack the derived characteristics of *Hypancistrus* (partially diagnosed by having dentary teeth nearly twice as long and wide as premaxillary teeth; Armbruster, 2002), *Panaque* (partially diagnosed by having spoon-shaped or greatly elongate, spatulate teeth; Armbruster, 2004), and *Parancistrus* (partially diagnosed by having the dorsal-fin connected to the adipose fin and enlarged gill openings; Rapp Py-Daniel, 1989; Armbruster, 2004). Those basal species in the *Panaque* clade except *Baryancistrus* are attributed to *Hemiancistrus*, which is defined as lacking acutely angled dentaries (the dentaries instead form an angle greater than 100°), due to the lack of the above apomorphies, and due to the lack of an expansion of the posterior dorsal-fin membrane that normally attaches to the adipose fin or preadipose plate as in *Baryancistrus*. Additionally, *H. medians, H. snethlageae, H. spilomma, H. guahiborum,* and *H. subviridis* share with *Baryancistrus* and a few other ancistrins not closely related to *Hemiancistrus* the presence of a condyle on the quadrate for articulation with the canal plate; however, the condyle is extremely small in these *Hemiancistrus* and *Baryancistrus*, and could be at best considered a dubious potential synapomorphy.

Use of a continuous character such as jaw angle is clearly not a perfect solution in defining genera. *Peckoltia furcata* often has a slightly oblique angle of the dentaries and *Hemiancistrus spilomma* and a few undescribed *Hemiancistrus* with color patterns close to the species of *Peckoltia* can approach a right angle. Clearly, this is far from the final word on the identity of *Peckoltia* and *Hemiancistrus*, and more work needs to be completed. Further elucidation of relationships using morphology seems to be impossible because there seems to be little pertinent or discreet variation in the problematic taxa.

The phenetic definitions of *Peckoltia* and *Hemiancistrus* are unsatisfactory for many reasons, but the current analysis offers no clues as to how to break up the genera or combine them. The entire *Panaque* clade could be sunk into a single genus (the oldest name would be *Acanthicus*), but this would probably not be

readily accepted by the scientific community and certainly would not be accepted by the public where these fishes have become a staple of the aquarium trade. Such a move would not increase taxonomic stability. It would also cause the lumping of very disparate groups of organisms. A simpler solution for just *Peckoltia* would be to place the species of *Peckoltia* (except *P. caenosa*) into *Panaque* because the clade was found to be monophyletic; however, the support for the clade is very weak, there are no adequate synapomorphies, and such a move would be premature.

A second possibility is to break the *Panaque* clade up into even more genera. This may be warranted in the case of New Genus 1 because it is very well diagnosed (to be discussed in a future paper), but the other taxa between basal *Hemiancistrus* and *Peckoltia/Panaque* would have inadequate diagnoses. For the stability of the other genera and to avoid introducing yet more genus names into the overcrowded Ancistrini, it seems best at this time to recognize two potentially paraphyletic genera (*Peckoltia* and *Hemiancistrus*) and to await molecular and perhaps more complex morphological analyses.

Isbrücker *et al.* (2001) described *Sophiancistrus* for *Hemiancistrus arenarius* and *H. ucayalensis*. These two species are identical to *P. bachi* and *P. filicaudata*. With *P. filicaudata* being the type of *Peckoltichthys*, if *P. bachi* were to be recognized in its own genus, it would be *Peckoltichthys*. *Peckoltia bachi* has a very strange morphology with the eye set low on the head, relatively large plates on the abdomen, and hypertrophied pelvic adductor muscles set into deep recesses of the pelvic basipterygium. These characteristics are reminiscent of *Hypoptopoma* of the Hypoptopomatinae. Although there would be a lot of synapomorphies to recognize *Peckoltichthys*, the phylogeny does not provide enough evidence to break off this single species into its own genus at this time.

Isbrücker *et al.* (2001) also describe *Ancistomus* with the basic definition that the single species assigned to it at that time (*Hemiancistrus snethlageae*) is intermediate between *Hypostomus* and the Ancistrini. This can be said for all basal members of the *Panaque* clade, including *Hemiancistrus medians,* and this is not an adequate diagnosis for a genus. The splitting of *Hemiancistrus* and *Peckoltia* by Isbrücker *et al.* (2001) was premature, and erroneous in the case of *Sophiancistrus*.

Ancistrus yaravi was considered to be in *Peckoltia* by Fisch-Muller (2003). The type of *A. yaravi* is lost (Mikschi, pers. com.) and the original description (Steindachner, 1915) does not have an illustration. The holotype was collected in the Río Coquenan of Venezuela, an area with very few ancistrin species. Besides species of *Ancistrus*, the only species of the Ancistrini I have examined from the region are *Pseudancistrus coquenani, Neblinichthys roraima,* and *Exastilithoxus fimbriatus*. An undescribed *Hemiancistrus, Pseudancistrus reus*, and an undescribed *Pseudancistrus* are also now known from the lower Caroni (pers. obs.). The description of *A. yaravi* in Steindachner (1915) provides two major clues as to the identity of this species. The first is the peculiar description of the color of the specimen as being violet-gray-brown. The second is that the pectoral- and pelvic-fin spines are the same length. These two characteristics fit *N. roaraima*. *Pseudancistrus reus* from the lower Caroni also has the pectoral- and pelvic-fin spines of approximately the same length, but it has bands on the body. It is unlikely that Steindachner would mistake *P. coquenani* and *E. fimbriatus* with *A. yaravi* as all three are described in the same publication (Steindachner, 1915). None of the *Peckoltia* or *Hemiancistrus* examined had the pectoral- and pelvic-fin spines of equal length. Freshly preserved specimens of *N. roraima* also have a peculiar color that could be described as violet-gray-brown (Fig. 27). For these reasons, I am recognizing *Neblinichthys yaravi* as the senior synonym of *N. roraima*.

Morphometry

The analysis of morphometry of the species of *Peckoltia* provided no useful characters. Although there were a few trends in morphometrics, no character provided complete separation between the species with the exception of minimum interorbital width vs. HL, which separated *P. bachi* from all other species (this analysis was only of a subsample of the specimens and does not deserve further reporting here). Although occasional minor differences could be found between species pairs, *P. vittata* spanned nearly the entire range of all spe-

cies. In a PCA, there was very little separation between species and *P. vittata* spanned nearly the entire morphospace occupied by *Peckoltia*.

In the vast majority of morphometric and meristic studies on loricariids that find differences between species, the studies are based on few individuals from few localities [for example see Armbruster and Provenzano, 2000; Armbruster 2003a, b (difference between *Hypostomus hemicochliodon* and *H. sculpodon*); Fisch-Muller *et al.* (2005a,b)]. In the few, wide-ranging morphometric analyses on hypostomines to date (for example see Armbruster, 1998a, 2003b, 2005, this study) little morphometric information is found to separate species. This may mean that morphology is conserved in many loricariid genera and that small morphometric studies are likely to lead to errors.

FIGURE 27. Dorsal view of *Neblinichthys yaravi*, AUM 36669 mm SL. Photograph by J.W. Armbruster.

Color

With no morphometric or meristic differences and no obvious differences in morphology (except the longer upper lobe of the caudal fin in *Peckoltia furcata* and the derived conditions of *P. bachi* mentioned above), the only difference between the species of *Peckoltia* is color. Color is obviously something that can evolve quickly. As with any study on South American fishes, sampling is incomplete, and reliance on color is problematic. This is especially true in *Peckoltia* where the only species that has been collected in any number is *P. vittata*, and then mainly at the edges of its range where the specimens do seem a little different from typical *P. vittata*. Color would be especially problematic if it is sexually selected as this would cause it to evolve rapidly; however, there is no dimorphism in color in *Peckoltia*.

Finding specimens that look like *Peckoltia brevis* in the Orinoco makes the situation with color even more difficult in *Peckoltia*. The range of *P. brevis* is bisected by the range of *P. lineola*, a similar species that has the spots combining to form short lines on the head vs. having the spots separate. The situation in the Orinoco with *P. brevis* and *P. lineola* could lead to at least three conclusions: that *P. brevis* has a wide range that just hasn't been determined yet, that color is so plastic, and the color patterns of *Peckoltia* fairly simple that a particular color pattern can evolve more than once, or that perhaps the Colombian Orinoco specimens are introduced. The distinction between these ideas would need to be explored using molecular techniques and more collections. Curiously, the collections of *P. brevis* in Colombia were from the same area as the collection of *Lepidosiren paradoxa*, the only known locality of the South American Lungfish in the Orinoco basin (Bogotá-Gregory and Maldonado-Ocampo, 2006).

Certainly this study is not the last word on *Peckoltia*. More collecting is needed to determine the extent of the ranges of the species. The descriptions of the species above provide a hypothesis to be tested by further

collecting and via molecular techniques, and it seems preferable to recognize species like *P. lineola* at this time to best demonstrate the known color diversity of the species, and certainly the color difference between *P. lineola* and *P. brevis* is on par with that found between any two species of *Peckoltia*.

The wide-ranging *Peckoltia vittata* does vary slightly in color across its range, but this was considered inadequate to split the species given that a very similar color pattern is seen in its far eastern and far western Brazilian range, and because not enough specimens are available in the center of its range with good color to understand the full extent of color variation in the species. It is likely that *P. vittata* as described above represents more than one species.

Biogeography

Analysis of biogeography using *Peckoltia* is problematic because there are no useful morphological differences that could be found upon which to derive a phylogeny; however, some trends can be noted. As noted in Armbruster and Werneke (2005), of the loricariids examined, only *Peckoltia* had different species in the Branco and Essequibo. This suggests that the seasonably flooded Rupununi savannah does not serve as a conduit between the two basins for species of *Peckoltia*. The other major portal region of the western Guyana Shield, the Río Casiquiare that connects the Upper Orinoco and the Río Negro; however, does serve as a conduit for *P. vittata* and possibly *P. brevis* into the Orinoco. The range of *P. vittata* suggests a connection between the Guyana and Brazilian Shields. The wide range of *P. vittata* further suggests that the lowlands of the Amazon basin might not provide sufficient barriers to speciation in species of loricariids that like slow- or moderate-flowing water. A similar result was found for *Hypostomus hemicochliodon* (Armbruster, 2003b) and *Lasiancistrus schomburgkii* (Armbruster, 2005), which were both found throughout the Amazon basin and into the Orinoco (with *L. schomburgkii* also being found in the Essequibo).

Material examined

In addition to the specimens examined in Armbruster (1998b; 2003a; 2004, 2005), Armbruster et al. (2007), and Lujan et al. (2007), the following specimens were examined (only numbers of cleared and stained specimens provided: *Baryancistrus demantoides* – AUM 42169, 1; *B. niveatus,* MNRJ 19344 (1), *Baryancistrus* sp., AUM 39227 (2); *Cordylancistrus platycephalus*, AUM 21714 (1); *Hemiancistrus megalopteryx*, MCP 35592 (1); *H. snethlageae*, MCP 15151 (1); *H. subviridis*, AUM 29231 (1); *Hopliancistrus tricornis*, AUM 39853 (3); *Hypostomus roseopunctatus*, MCP 22674 (1); *H. sculpodon*, AUM 39476 (1); *Panaque changae,* AUM 28908 (2); *Pseudolithoxus anthrax,* AUM 39229 (1), AUM 39232 (1); *P. dumus*, AUM 39508 (1); New Genus 1, AUM 42205 (2); New Genus 2, AUM 39476 (1); New Genus 2, AUM 45538 (2) and AUM 45571 (2).

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Appendix 1. Character state matrix. A: 0 and 1, B: 1 and 2, C: 2 and 3

OUTGROUP - Callichthyidae
Corydoras
00000000000000000000000001100000000000000001000000000000300010100000000000000000???00?00000000
0000?0000000300000000000100000000010000000100000000000A00110000000000000000010000000000000000000
000110000000000000000000
Dianema
10000000000000000000000001100000001000000001000000000000000000102000000000000000000???00?00000000
0000?0000100300000000010100000000000000000010000000000A000100000010000000?00000000000000000000000
000110000000000000000000
Hoplosternum
10000000000000001000000001100000000000000001000000000000000000102000000000000000000???00?00001000
0000?0000100300000000010100000000000000000010000000000A000100000010000000?00000000000000000000000
000110000000000000000000

INGROUP
Astroblepidae
Astroblepus
10200000000000000001101100000000000000000000?000000000000000000010010000010000110???000021000020
00100000000000000000000010000002000000001210000 21?1?000100012010111101100010141000001000000000010
0100000000000000000000
Loricariidae-Delturinae
Delturus anguillicauda

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10200001000000000010000120000001200001100020011010100A000001020101101021010100200000011000010011 1
013200010000000000000
Hemipsilichthys gobio
10100011000001000101101000011100000100000001000000110000000000020100000010000000110???001011000002
10200001000000000010000100000101200101100020000010110A010000120101101021010000200000011000010011 1
013200010000000000000
Loricariidae-Hypoptopomatinae
Hisonotus sp.
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10200101010210000000000?110011000010011011200000000101000200000010010000?000002000000100000000101
00210001110000000000000
Hypoptopoma sp.
00200011010000111100000000201100000100000010?000001211000000000110000000001000001010000100110101 11
00200102000000000000000111001100100000100120100000001?100020000001001000100000020000001000000001 01
00220001110000000000000
Nannoptopoma spectabila
00200011000000111100001000200000001100000010?000001211000000000110000000001000001010000100110101 11
00200102000200000000001110011001000000110112010001001?100020000001001000100000020000001000000001 0101
00220001110000000000000
Otocinclus vestitus
00200011011001111100000000201100001100000010?000000000000000002120000000001000000010000110110101 10
00200102010200000000000?110011010010001011200000100001000201001010010001000100200000010000000010 1
00220001110000000101000
Otocinclus vittatus
00200021011001111100000000201100001100000010?000000000000000002120000000001000000010000110110101 10
00200102010200000000000?1100110100100A10112000001000010002010010100100010001002000000100000000101
00220001110000000101000
Parotocinclus britskii
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00220001010000000000000
Schizolecis guentheri
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21020010100021100000000?110010000010011011201000100 1?101010102011001000?001002000000100000000101
00220001010000000000000
Loricariidae-Hypostominae-Ancistrini
Acanthicus hystrix
10000022011001011101001000100100110000000002000000122000200010010001000000100001211010030111100 01
00210000010112000000000?BA10000121100110112001001000010000010210011100111010102000000122000101101
01311001010000000000001
Ancistrus pirareta
00100022010001011101100002101101110100110102000100122000200011000100000001212001211010020110100 01
10210002000012000010011101000002000010001200000100002000001020001110001001010200000012200000110 1
01220000000000032000000
Ancistrus sp.
00100022010001011101100002101101110100110102000100122000200011000100000001212001211010020110100 02
10210002000012000000011201000002000010001200000101002000001020001110001001010200000012200000110 1
01220000000000032000000
Baryancistrus sp.
00100022010001011101000021001001101000000020000001220002000110111000000011000111110100301201000 2
00200001000012010000010201000002000000001200010100002000000010001110011001010200000012200000110 1
01310001010000000000000
Baryancistrus sp. (called *B. niveatus* in Armbruster, 2004; not used in this analysis)

00100022010001011101000002100100110000000102000000122100200011011100000001100011111010030110100010021000100001201000001120100000200000000120001010000200000001000111000100101020000001220000011010131010100000000000000
Baryancistrus demantoides
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Baryancistrus niveatus
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Chaetostoma anomala
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Chaetostoma pearsei
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Chaetostoma sovichthys
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Chaetostoma stannii
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Chaetostoma platyrhynchus
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Cordylancistrus platycephalus
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Cordylancistrus torbesensis
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Dekeyseria pulcher
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Dekeyseria scaphirhyncha
00100022011001011100000000100100010100100101000000122000200011000100000001210001111010030120100001020010010000012000000001201010002000001A00120000010000100001102A011100211010102000000122000101101012101100100000011000000
Dolichancistrus cobrensis
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Dolichancistrus pediculatus
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Exastilithoxus fimbriatus
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Exastilithoxus sp.
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Hemiancistrus guahiborum
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01310101010000000000000
Hemiancistrus landoni
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00200001000012000000011101000002000000001200000100002000001000001110011001010200000012200000110101
01310001010000000000000
Hemiancistrus megalopteryx
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Hemiancistrus micromattos
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01310101010000000000000
Hemiancistrus sabaji
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Hemiancistrus snethlageae
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00200001000012000000011201000002000000001200000100002000001010001110011001010200000012200000110101
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Hemiancistrus subviridis
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00200001000012000000011201000002000000001200000100002000001010001110001001010200000012200000110001
01310001010000000000000
Hopliancistrus tricornis
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10200001000012000000001201000012000011001200000100001000000020101110011001110200000012200010110101
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Hypancistrus contradens
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Hypancistrus furunculus
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Hypancistrus zebra

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Lasiancistrus caucanus
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Lasiancistrus guacharote
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Lasiancistrus tentaculatus
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Leporacanthicus galaxias
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Leptoancistrus canensis
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Lithoxus bovallii
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Lithoxus lithoides
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Megalancistrus gigas
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Neblinichthys pilosus
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Neblinichthys yaravi
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Panaque aureatus
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Panaque changae
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01310101010000000000
Panaque maccus
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Panaque nigrolineatus
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Parancistrus auarantiacus
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Peckoltia bachi
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Peckoltia braueri
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Peckoltia cavatica
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Peckoltia caenosa
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Peckoltia brevis
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Peckoltia furcata
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Peckoltia lineola
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Peckoltia vittata
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Pseudacanthicus leopardus
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Pseudancistrus sp.
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Pseudancistrus barbatus

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Pseudancistrus brevispinnis
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Pseudancistrus megacephalus
00100022011000011101100002100100101100000000100000012200121001101010000000110000111101003011010001102100000000120000010112010000020000100012000001000020000000200011100111011102000000122000001101013100010000000?????0
Pseudancistrus orinoco
01001022011001011101100002000100101100000000101000012200021000001010000000110000101101003011010001102000000000120000010112010 0A00200001100120000010000100000002010110001110111020000101220001011010132000100000011000000
Pseudancistrus sidereus
00000022011001001101000002000100101100000000100000012200121001100000000000110000111101002022010001102010000000121000010111010000020000100012000001000010000000201011100211011102000000122000001101013100010000000000000
Pseudancistrus yekuana
00100022000001011101000002100100011100000002010001122000210000010100000001100001011000020120100021020100000000110000010102010000120000110012000001000010000000200011000211011102000001012100?01101013200010000000?1000000
Pseudolithoxus anthrax
00100022011001011101100002100101010100110102000100122000200011010100000001212001211010030110100012020000100012010100010101000002000010001200000100001000001020001110001001010200000012200010110101210010001000011000000
Pseudolithoxus dumus
10100022011001011101100001100101010100110102000100122000200011010100000001212001211010030110100012020000100012010100010101000002000010001200000100001000001020001110001001010200000012200010110101210010001000011000000
Spectracanthicus murinus
10100022001001011101000002100100010000000102010000123010210000010111101001000101111000020110100012021000101000010100000011201000002000010001200010100003000001020001110001001010200000010100000110132000101020000000000
Spectracanthicus sp.
1010A022000001011101000002100100110000000102010000122010210000010101100001100001111010030110100011021000100001110000001120100000200001000120001010000300000102000111000100101020000001220000011010132000101020000000000
New Genus 1
10100022001001010101000001101100110000000102010010010000000000010101100001100011111010030120100000021000101011201001001020100000201000000120000010000200000102010111000100101020000001220000011010132100100020000000001
New Genus 2
00100022010001101101000000201101010100110102000000122101200011011100000001212001211010020110100012021000000011000000000010100000100001100120000010100200000102010110001100101020000001220000011010121000000000001000000
New Genus 3
00100022011001011101000002101100110100000001000000122000200001010100000001100001111010030120100012020000100001101000101020100000200110000120000010000200000101000111000100101020000001220000011010131000101000000000000
Loricariidae-Hypostominae-Corymbophanini
Corymbophanes andersoni
10100021000001111100000001101000010100000002010000122000210001110100000001000001011010010110100012020000100001101000101020100000200110000120000010000200000101000111000100101020000001220000011010131000101000000000000

10101001000010000000001111000000000001010200000100001000000020101110011101010200000010000000011101220001000000000000000
Corymbophanes kaiei
10100021000001111100000001100000010100000001010000122000210001110100000001000001011010010110100011010000010000100000000011110000100000000102000001000020000000101011100011010102000000100000000111012200010000000000000
Loricariidae-Hypostominae-Hypostomini
Hypostomus ammophilus
00210021010001011100001100200100110100000001000000122000100000010100000000100010B110000202211100101200001000001010000001000100000000110000120000010000200000010100011100110010102001100101000001101013101010110000000000
Hypostomus unicolor
00210021010001011100001100200100110100000001000000122000100000010100000000100010111100002022111001012000010000010100000010001000000001100001200000100002000001010001110011001010200110010100000110101310101011000000000
Hypostomus cochliodon
10100022010001101101000A2100100110000000002010000122000200000010100110001000101111000020110110020020000100001110000001110100000000110010120000010000200000100000111001100101020000001010000011010131000101010000000000
Hypostomus hondae
10000022010001001101000012100100110000000002010000122000200000010101110000000101211000020110110010020000100001110000001110100000000110010120000010000200000100000111001100101020000001010000011010131000101010000000000
Hypostomus plecostomoides
10100022010001001101000012100100110000000002010000122000200000010101110000000101211000020110110020000010000111000000A1010000000011000012000001000020000010000011100110010102000000101000001101013100010101000000000
Hypostomus hemicochliodon
10100022011001001101000012100100110100000002010000122000200000010101100000000101211000020110110020000010000111000000111010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
Hypostomus albopunctatus
10100022010001001101000002100100110100000002000000122000200000010100000001000101111000020120110011020000100001110000001110100000000110000120000010000200000101000111001110101020000001010000011010132000101000000000000
Hypostomus villarsi
00200022010001001100000012100100110100000001000000122000100000010100010001000101111000020110110020020000100001110000001110100000000000000120000010000200000101000111001100101020010001010000011010131010101000000?????0
Hypostomus bolivianus
10100022011001001101000002100100110100000002000000122000200000010100000001000101111000020110110010020000100001110000001110100000000110000120000010000200000101000111001100101020000001010000011010131000101000000000000
Hypostomus boulengeri
10100022010001001101000012100100110100000001000000122000200000010100010001000101111000020110110010020000100001110000001110100000000000000120000010000200000100000111001100101020000001010000011010131000101000000000000
Hypostomus round snout1
10100022011001001101000002100100110100000002010000122000200000010100000001000101111010020110110010020000100001110000001120100000000111000120000010000200000101000111001100101020000001010000011010131000101000000000000
Hypostomus round snout2
10100022010001001101000012100100110100000001000000122000200000010100000000000101111000020110110010020000100001110000001110100000000A100001200000100002000001010001110011001010200000010100000110

10131000101000000000000
Hypostomus cordovae
10100022010001001101000012100100110100000002000000122000200000010100000000000101111000020110110020020001000011100000011101000000001110001200000100002000001010001110011001010200000010100000110101310001010000000000
Hypostomus emarginatus
00100022010001111100001002100100110100000001000000122000100000010100000000000101111000020121110001200001000011100000011101000000001100001200000100002000001000001110011001010200100010100000110101310101010000000000000
*Hypostomus emarginatus*2
00100022010001111100001002100100110100000001000000122000100000010100000000100010111100002022111001012000010000111000000100010000000011000012000001000020000010100011100110010102001000101000001101013101010100000000000
Hypostomus francisci
10100022010001001101000A2100100110101000002010000122000200000010100000000100010111100002012011001002000010000101000000111010000000011000012000001000020000010100011100110010102000000101000001101013100010100000000000
Hypostomus rhantos
10100022011001001101000012100100110100000001000000122000200000010100000000000101111000020110110010020000010000101000000112010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
Hypostomus plecostomus
10100022010001001101000012100100110100000002000000122000200000010101000000000010111100002011011001002000010000101000000111010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
*Hypostomus plecostomus*2
10100022010001001101000012100100110100000002000000122000200000010100000000000101111000020110110020020000100001010000001110100000000110000120000010000200000100000011100110010102000000101000001101013100010100000000000
Hypostomus punctatus
10100022011001001101000002100100110100000002000000122000200000010101000001000101111000020110110010020000010000101000001A10100000000110000120000010000200000010A000111001100101020000001010000011010131000101000000000000
Hypostomus robinii
10000022011001001101000012100100110100000001000000122000200000010100010000000101111000020110110010020000010000101000000111010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
Hypostomus roseopunctatus
00100022011001001101000002100100110000000002000000122000200000010101100000000010121100002011010002002000010000111000000102010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
Hypostomus sculpodon
10100022011001001101000002100100110100000002010000122000200000010101100000000010121100002011011002002000010000111000000111010000000011000012000001000020000010000011100110010102000000101000001101013100010100000000000
Hypostomus spinosissimus
10000022010001001101001001100100110100000011000000122000200000010101000000000101111000020120110010012000010000111000000100100000000000000120000010000200000101000111001100101020010001110001011010131010101000000000000
Hypostomus squalinus
00100022010001111100001001200100110100000011000000122000100000010100000001000101111000020121110010012000010000111000000100010000000011000012000001000020000010000011100110010102001000101000001101013101010100000000000
Loricariidae-Hypostominae-Pterygoplichthyini

Hemiancistrus panamensis
10100022011001001101000002100100110100000001000000122000100000010101000000000001211000030110110010020001000011100000011101OA000000000000120000010000200000000000011100110010102000000122000001101013100010100000000100
Hemiancistrus holostictus
10100022011001001101000002100100110100000011000000122000200000010100010000000101211000030110110010020001000011100000011101000000000100001200000100002000000000001110011001010200000012200000110101310001010000000010
Hemiancistrus maracaiboensis
10100022011001001101000002100100110100000011000000122000200000010100000000000001211000030110110010020001000011100000011101000000000100001200000100002000000000001110011001010200000012200000110101310001010000000010
Pterygoplichthys multiradiatus
00200021010001001101000A020010011010000001100000012200110000001010000000100000121100003012011001012000002000010000000011201000000000000001200100000002000000000001110011001010200000010200000110101310001010000000010
Pterygoplichthys pardalis
00200021010001001101000000200100110100000011000000122001100000010100000001000001211000030120110010020000020000110000000112010000000010000012001001000020000000000001100110010102000000102000001101013100010100000000100
Pterygoplichthys gibbiceps
10100021011001001100000000200100110100000011000000122001200000010100000000000001211000030120110010020000020000110000001112010000000000000012001000A000020000000000001100110010102000000122000001101013100010100000000100
Pterygoplichthys lituratus
10100021010001001100000000200100110100000011000000122001100000010100000000000001211000030120110010020000020000110000001112010000000000000012001000000020000000000011100110011102000000122000001101013100010100000000100
Pterygoplichthys punctatus
00100022010001001101000000200100110100000001000000122000100000010100010001000011211000030120110010020000020000110000100112010000020000000012001000000020000000000011001100101020000001220000011001310001010000000010
Pterygoplichthys etentaculatus
10100022010001101101000000200100110100000011000000122000100000010100000001000001211000030110110010020000020000110000000112010000000011000012001000A000020000000000011100110010102000000122000001101013100010100000000100
Pterygoplichthys zuliaensis
00200022011001001100000000200100110100000011000000122001100000010100000001000001211000030110110010020000020000110000000112010000000000000012001000000020000000000011001100101020000001220000011010031000101000000000100
Loricariidae-Hypostominae-Rhinelepini
Pogonopoma wertheimeri
10200022010001001111000010100110001100000001000000122100101011010000000010000001010000020110110010120000021000100000000011110000010100000012000001000010000010100001100211011112000000120000100101113100010100000013000
Pogonopoma parahybae
00200022010001001101000010100110001000000001000000122100101011010000000010000001110000020110110010120000021000100000000?1110000010100010112000001000010000010100100100211011112000000100000001101113100010100000013000
Pseudorinelepis genibarbis
00200022011001001101000000200110A011000000010001001220002010000200000000010000010110000201101100100200002100010000000007201000001000000011200000100001000000000010010011101110200000012000010010101310001010000000110000
Rhinelepis aspera

10200022010001001111001010100110000100000001000000122000201011010000000001000001012000020110110010120000021000000000000001201000001000001011200000100001001010010000110011101010200000010000000001011131000101000000120000
Loricariidae-Lithogeninae
Lithogenes villosus
00??000000000000000000000001100000101000000021000101000000000000010000000010000001000???000021100001101000000000100000100000100010020010000012100002 1?1?000100012010101100110010021000001000000001010120000000000000000000
Loricariidae-Loricariinae
Crossoloricaria venezuelae
00010000111112000000010001010000010100000000?000011200102001000100001001000000010110000201111000210100101101010000000000?010110102000001011201001000 1?10010100200011000000?000000000100100000010001002100010100100000000
Crossoloricaria sp.
00010000111112000000000001010000010100000000?000011200102001000100001001010000001011000020111100021020010110101000001000?010110102000001011201001000 1?10010101201011000000?000000000100100000010001002100010100100000000
Harttia sp.
10000011011000001101000001011100000100000001000000122000200000010000000010000001110000010111100010020010100001100000000?010110100000010011200000000 10101000010211110100210010002000000100000000001002100010100000000000
Ixinandria montelbelloi
00000000000000000100001001010000000100000001000001100000000010101000010010100000101000001011110002102000010010000000000?010110100000000011200001000 10101000011020101010011001000300000011000011000100220001010000000000
Lamontichthys llanero
01000011011000001100000001010100100100000000100000012210020000001000000000100000111000002011110001002001010000100000000?010110100000010011200001000 10101000000200100100210000002000000100000000001002100010100000000000
Loricaria cataphracta
00000000111112000000010001010000000100000000?000011200102001100100001001000000010110000201111000210200001101010000000?010110100000001011201001100 1?10010100201110000?010003000100100000010001002100010100000000000
Loricariichthys brunneus
00000000110002000100010011010000010100000001000001120011000111010000100100000001011000010121100021020000110101000001000?010110100001000011201001000 1?10010100201110100110000100000000100000010001002200010100000000000
Rineloricaria rupestris
00000000100002000100001001010000000100000001000001100000000011100000010010100000101000001011110002102000010010000000000?010110100000000011200001000 10101000011020101010011001000300000011000011000100220001010000000000
Sturisoma festivum
00000011011001001100000000201010000010000001100000012200020000001000000000100000101001001011110002002000110000100000000?010110100001000011201001000 10101000010200100000110000103000000110000100001002200010100000000000
Sturisomatichthys citrensis
00000011011001001100000000201010000010000001100000012200020000001000000000100000101001001011110002002000110000100000000?010110100001000011201001000 10101000010021001010200000011000010000100220001010000000000
Loricariidae-Neoplecostominae
Neoplecostomus microps
00200011000000011100001000100000000100000002000000100000100000011000000001000010111000101011010002102000010000000000010001A1001001000001100120100010010111000012010110000110011010100011000000001012200010100000000000

Neoplecostomus paranensis
00200011000000011100001000100000A0100000002000000122000200000110000000010000101110001110110100021020000010000000000010001A1001001000001100120100010010111000012010110000011001101010001100000000101111220001010000000000
Pareiorhaphis bahianus
10200021000001011101001000101100001100000001000000122000100000110000000000000001110011010110100121020000100001000000001110011000000011001201000100101000000020111010001000100200000011000110010101220001000000000000000
Pareiorhaphis cameroni
10100021000001011101000000101100001100000001000000122000200000110000000001000001011011010110100121020000100000000000001110011010000011001200000100101010000002010110000100010020100011100011001010122000100000000000000
Pareiorhaphis nudulus
10200011000001011101001100101100000100000001100000121000200002110010000001000000010011000110100121020100100000000000000?2000100020000010100??00021?1?C000001020101110011000010201000011000110010101300001000000000000000
Pareiorhaphis splendens
10200021000001011101000000101100001100000001000000121000200000110010000001000000011101101101101212020100100000000000001100011000000011000200000100101010001020101110001000000201000111000110010101220001000000000000000
Pareiorhaphis sp.
10200021000001011101100000101100001100000001000000122000200000110000000001000001111011000110100120020000100000000000001110011000000011001200000100101010000020101110001100100200000111000110010101220001000000000000000
Pareiorhaphis?
10210021000000011101001000201100001100000011010000121010100000110000000001000000010000020110100121020000010000100000000011100100000000110012010001001010000001201110100011001002010000?000?000101013200010000000000000
Isbrueckerichthys alipionis
00210011000001011100000000101100001000000021000001210001000001100000000100000011120011101101001210200001000000000000011100110000000110012010001001?10100001201011000011001002010001110001100101132000101000000000000
Isbrueckerichthys duseni
00210021000001011100000000101100001000000021000001210001000001100000000100000011120011101101001210200001000000000000001001100000000110012010001001?10100001201011000010001002010001110001100101132000101000000000000
Kronichthys sp.1
10200011000001011101000000201100001000000010000001210002000001100000000010001000100000101101001210200001000001000000A0011100110000000110012010000A00101000001020101110000?00100201000010000000010101220001000000000000000
Kronichthys sp.2
10200021000001011101001000201100001000000010000001210002000101100000000001000100010000010110100121020000100001000000100111001100000001100120100010010100000010201011100001?00100201000010000000010101220001000000000000000
Pareiorhina rudolphi
10200011000000011101001000101100001000000011000000122000200000110000000001000100012010110110101212020000100000000000?1100110000000110112010001001010000010201011100010001002010000100000000101112200010000000000000
Pareiorhina sp.
10200011000001011101001000201100000000000002A000001220002000101100000000010001001100010101101001210200001000000000000?1100110000000110112010001001010110001201011010001?00100201000110000000010111220001000000000000000

Appendix 2. Character state changes plotted on a random tree. Only unambiguous changes noted. Clades named based on the flanking taxa in figures 22–25 of the clade or by taxon name when appropriate. NUC = no unambiguous changes, NA = not available because the species is part of a polytomy in the tree. Only nodes present in the strict consensus tree (Figs. 22–25) are detailed.

Corydoras
1: 1->0
58: 0->3
131: 0->1

Dianema
35: 0->1

Hoplosternum
17: 0->1
93: 0->1

Astroblepus
21: 0->1
23: 0->1
24: 0->1
27: 1->0
44: 1->0
67: 0->1
74: 0->1
96: 0->2
167: 0->1
174: 0->1
175: 2->4
196: 2->0

Lithogenes villosus
1: 1->0
28: 0->1
34: 0->1
44: 1->2
49: 0->1
73: 0->1
92: 0->1
97: 0->1
110: 0->1
116: 0->1
126: 0->1
132: 0->1
169: 0->1

Neoplecostomus microps
52: 2->0
53: 2->0

Neoplecostomus paranensis
57: 1->2

Isbrueckerichthys alipionis
NUC

Isbrueckerichthys duseni
74: 0->1
120: 1->0
121: 1->0

Pareiorhaphis bahianus
110: 0->1
161: 0->1
163: 1->0
177: 1->0

Pareiorhaphis cameroni
3: 2->1
23: 1->0
83: 0->1
128: 0->1
141: 1->0

Pareiorhaphis nudulus
24: 0->1
45: 0->1
53: 2->1
62: 0->2
67: 0->1
88: 1->0
102: 0->1
121: 1->2
122: 1->0
126: 1->0
129: 0->2
134: 1->0
138: 1->0
139: 2->0
145: 1->2
146: 0->1
150: 1->2
167: 0->1
172: 1->0
173: 0->1
196: 2->3
197: 2->0

Pareiorhina rudolphi
14: 1->0
43: 0->1
78: 0->1
83: 0->2
87: 0->1
194: 0->1

Hypoptopoma sp.
109: 2->0
129: 0->1
137: 1->0
145: 1->0

Nannoptopoma spectabila
23: 0->1
29: 1->0
30: 1->0
174: 0->1

Otocinclus vestitus
NUC

Otocinclus vittatus
7: 1->2

Hisonotus sp.
145: 1->0
197: 2->1

Parotocinclus britskii
61: 0->1
85: 0->1
128: 0->1
137: 1->0
148: 1->0

Schizolecis guentheri
29: 1->0
30: 1->0
111: 0->1
126: 1->0
152: 0->1

Kronichthys sp.
78: 0->1
137: 1->0

Crossoloricaria venezuelae
100: 2->1
160: 1->0

Crossoloricaria sp.
22: 1->0
74: 0->1
116: 0->1
157: 0->1

Loricaria cataphracta
145: 0->1

Loricariichthys brunneus
25: 0->1
56: 0->1
91: 1->2
116: 0->1
132: 0->1
173: 0->1

Ixinandria montelbelloi
14: 2->0

Rineloricaria rupestris
64: 1->0

Harttia sp.
1: 0->1
20: 0->1
29: 0->1
73: 0->1
74: 1->0
111: 0->1
144: 1->0
159: 0->1

Lamontichthys llanero
2: 0->1
33: 0->1
54: 0->1
88: 1->2

Sturisoma festivum
164: 1->0
175: 2->3

Sturisomatichthys citrensis
NUC

Corymbophanes andersoni
29: 0->1
44: 1->2
102: 0->1
135: 0->1

Corymbophanes kaiei
128: 0->1
150: 1->2
167: 1->0

Pogonopoma wertheimeri
137: 1->0
183: 0->2
188: 0->1

Pogonopoma parahybae
1: 1->0
36: 1->0
81: 0->1
161: 0->1
163: 1->0
190: 0->1

Rhinelepis aspera
23: 0->1
110: 1->0
153: 0->1
155: 0->1

Pseudorinelepis genibarbis
1: 1->0
11: 0->1
27: 1->2
48: 0->1
64: 1->2
158: 1->0
161: 0->1
163: 1->0
183: 0->2
188: 0->1

Hypostomus ammophilus
NUC

Hypostomus unicolor
NUC

Hypostomus emarginatus
15: 0->1
97: 1->0
158: 1->0

Hypostomus squamosissimus
3: 1/2->0
26: 2->1
43: 0->1
68: 0->1
183: 0->1
188: 0->1

Hypostomus villarsi
25: 0->1
70: 0->1
97: 1->2

Hypostomus cochliodon
15: 0->1
68: 1->0
74: 0->1
136: 0->1

Hypostomus plecostomoides
NUC

Hypostomus hemicochliodon
NUC

Hypostomus roseopunctatus
1: 1->0
36: 1->0
46: 1->0
94: 1->0
120: 1->0
121: 1->2

Hypostomus sculpodon
NUC

Hypostomus plecostomus
111: 1->0

Hypostomus cordovae
134: 0->1

Hypostomus albopunctatus
NA

Hypostomus bolivianus
NA

Hemiancistrus panamensis
68: 0->1

Hemiancistrus holostictus
70: 0->1
78: 0->1

Hemiancistrus maracaiboensis
NUC

Pterygoplichthys multiradiatus
99: 0->1
111: 1->0
162: 0->1

Pterygoplichthys pardalis
132: 0->1
145: 0->1

Pterygoplichthys zuliaensis
11: 0->1
91: 2->1
195: 1->0

Pterygoplichthys gibbiceps
11: 0->1
57: 1->2

Pterygoplichthys lituratus
162: 0->1
172: 0->1

Pterygoplichthys punctatus
70: 0->1
79: 0->1
116: 0->1
129: 0->2
198: 0->1

Pterygoplichthys etentaculatus
15: 0->1
105: 1->2
132: 0->1
133: 0->1

Acanthicus hystrix
8: 1->2
23: 0->1
49: 1->0
69: 1->0
91: 2->1
92: 0->1
105: 1->0
137: 0->1
159: 0->1
169: 0->1
205: 2->0

Megalancistrus gigas
36: 0->1
53: 2->0
55: 0->1
74: 0->1
98: 0->1
134: 1->0

Pseudacanthicus leopardus
15: 0->1
88: 3->2
160: 0->1

Leporacanthicus galaxias
7: 2->1
11: 1->0
17: 1->0
23: 0->1
30: 1->0
57: 2->1
67: 0->1
71: 0->1
83: 1->0
90: 1->2
92: 0->1
118: 0->1

Spectracanthicus murinus
33: 1->0
53: 2->3
67: 0->1
71: 0->1
75: 1->0
78: 0->1
85: 1->0
88: 3->2
111: 1->0
150: 2->3
183: 2->0
184: 2->1
203: 1->0

Spectracanthicus sp.
11: 1->0
128: 0->1

New Genus 1
17: 1->0
51: 1->0
52: 2->1
53: 2->0
57: 2->0
97: 1->0
107: 0->1
109: 0->1
116: 0->1
120: 1->0
131: 0->1
160: 0->1
203: 1->0
215: 0->1

Panaque albomaculatus
121: 1->2

Panaque changae
61: 0->1
81: 1->0
120: 1->0

Panaque maccus
NUC

Panaque nigrolineatus
11: 1->0
20: 1->0
61: 0->1
89: 0->1
90: 1->2
107: 0->1
130: 0->1
215: 0->1

Panaque aureatus
52: 2->1
53: 2->0
81: 1->2
126: 0->1
133: 0->1
158: 0->1
169: 0->1

Peckoltia bachi
3: 0->1
16: 1->0
20: 1->0
26: 2->1
38: 0->1
44: 2->1
64: 1->2
70: 1->0
79: 1->0

Peckoltia sabaji
5: 0->1
11: 1->0
21: 0->1
26: 2->1
43: 0->1
94: 0->1

Hemiancistrus landoni
16: 1->0
158: 1->0
167: 0->1

Hemiancistrus guahiborum
77: 0->1

Hemiancistrus micromattos
94: 0->1
133: 0->1

Hemiancistrus snethlageae
167: 0->1

Hemiancistrus megalopteryx
16: 1->0
20: 1->0
197: 1->2

Baryancistrus demantoides
44: 2->1

Baryancistrus niveatus
81: 1->2
167: 0->1

Baryancistrus sp.
36: 1->0
42: 0->1
54: 0->1
101: 0->1
199: 0->1
203: 1->0

Ancistrus pirareta
116: 0->1

Ancistrus sp.
97: 1->2
121: 1->2
147: 0->1

Lasiancistrus caucanus
120: 1->0

Lasiancistrus guacharote
NUC

Lasiancistrus tentaculatus
208: 1->2

Pseudolithoxus anthrax
NUC

Pseudolithoxus dumus
1: 0->1
26: 2->1

Chaetostoma anomala
157: 0->1

Chaetostoma sovichthys
64: 2->1
135: 0->1

Chaetostoma stannii
167: 1->0

Chaetostoma platyrhynchus
11: 0->1
150: 1/2->3
209: 0->1

Cordylancistrus platycephalus
8: 2->1
30: 1->0
77: 1->2
120: 1->0
121: 2->1
134: 1->0
149: 1->0

Dolichancistrus cobrensis
2: 1->0
8: 2->1
21: 1->0

Dolichancistrus pediculatus
NUC

Leptoancistrus canensis
1: 0->1
15: 0->1
45: 0->1
48: 0->1
137: 0->1
138: 1->0
150: 1->4
167: 1->0
169: 1->0
192: 0->1

Cordylancistrus torbesensis
29: 0->1
91: 1->2
132: 0->1
167: 1->2

Exastilithoxus fimbriatus
91: 1->2
121: 1->2
190: 1->0

Exastilithoxus sp.
21: 0->1

Lithoxus lithoides
77: 1->2

Lithoxus bovallii
97: 2->1
106: 0->1

New Genus 2
15: 0->1
27: 1->2
29: 0->1
54: 0->1
56: 0->1
81: 1->2
120: 1->0
129: 2->1
150: 1->2
156: 0->1
201: 1->0

Hopliancistrus tricornis
121: 1->2
128: 0->1
172: 0->1
196: 2->3
210: 0->1

Neblinichthys pilosus
97: 1->2
121: 1->2
160: 1->0

Neblinichthys yaravi
135: 0->1

Dekeyseria pulcher
56: 0->1
81: 1->2
172: 0->1

Dekeyseria scaphirhyncha
20: 1->0
64: 1->0
91: 1->2
102: 0->1
119: 1->0
121: 1->2

Pseudancistrus sp.
97: 2->1
126: 0->1

Pseudancistrus barbatus
85: 1->0
91: 1->2
167: 2->1

Pseudancistrus orinoco
2: 0->1
5: 0->1
27: 1->0
97: 2->1
128: 1->0
167: 2->1

Pseudancisrus yekuana
10: 1->0
11: 1->0
21: 1->0
33: 1->0
34: 0->1
44: 1->2
50: 0->1
85: 1->0
88: 3->2
91: 1->2
102: 0->1
184: 2->1

Pseudancistrus pectegenitor
29: 0->1
46: 1->0
67: 0->1
117: 1->0
119: 1->0
134: 1->0
142: 0->1
145: 1->0
158: 2->1

Pseudancistrus brevispinnis
11: 1->0
16: 1->0
26: 2->1
33: 1->0
164: 1->0

Pseudancistrus megacephalus
101: 0->1
150: 1->2
160: 1->0
167: 2->1

Pseudancistrus sidereus
3: 1->0
16: 1->0
27: 1->0
64: 1->0
66: 1->0
88: 3->2
90: 1->2
91: 1->2
102: 0->1
112: 0->1

New Genus 3
29: 0->1
91: 1->2
117: 0->1
120: 1->0
121: 1->2
132: 0->1
133: 0->1
156: 0->1

Delturus anguillicaudatus
11: 0->1
91: 1->2
97: 2->1
121: 1->2
142: 0->1
143: 0->1
148: 1->0

Hemipsilichthys gobio
21: 0->1
121: 1->0
126: 0->1
132: 0->1
152: 0->1
157: 0->1
172: 1->0

below *Corydoras* - *Hoplosternum*
26: 1<->0 *
62: 1<->0 *
91: 0<->1 *
100: 0<->1 *
109: 3<->0 *
139: 1<->2 *
145: 0<->1 *
148: 0<->1 *
154: 1<->0 *
158: 0<->2 *
160: 0<->1 *
162: 0<->1 *
168: 0<->1 *
175: 0<->2 *
182: 0<->1 *
193: 0<->1 *
195: 0<->1 *
196: 1<->2 *

below *Dianema* - *Hoplosternum*
64: 1->2
106: 0->1
119: 0->1
161: 0->1
172: 1->0

below *Astroblepus* - *Hemipsilichthys gobio*
26: 1<->0 *
62: 1<->0 *
91: 0<->1 *
100: 0<->1 *
109: 3<->0 *
139: 1<->2 *
145: 0<->1 *
148: 0<->1 *
154: 1<->0 *

158: 0<->2 *
160: 0<->1 *
162: 0<->1 *
168: 0<->1 *
175: 0<->2 *
182: 0<->1 *
193: 0<->1 *
195: 0<->1 *
196: 1<->2 *

below *Astroblepus* - *Lithogenes villosus*
79: 0->1
121: 1->0
140: 0->1
145: 1->2
146: 0->1
157: 0->1
176: 0->1

below *Neoplecostomus microps* - *Hemipsilichthys gobio*
7: 0->1
8: 0->1
14: 0->1
18: 0->1
30: 0->1
52: 0->1
97: 0->2
100: 1->2
105: 0->1
120: 0->1
201: 0->1

below *Neoplecostomus microps* - New Genus 3
17: 0->1
52: 1->2
53: 0->2
57: 0->2
74: 0->1
82: 0->1
93: 0->1
137: 0->1

below Neoplecostominae + Hypoptopomatinae
16: 0->1
63: 0->1
96: 0->1
126: 0->1
141: 0->1

below *Neoplecostomus microps* - *Pareiorhina rudolphi*
23: 0->1
85: 0->1

below *Neoplecostomus microps* - *Pareiorhaphis nudulus*
86: 0->1
183: 0->1
187: 0->1
188: 0->1

below *Neoplecostomus microps* - *Pareiorhaphis cameroni*
80: 0->1
137: 1->0
156: 1->0

below *Neoplecostomus microps* - *Isbrueckerichthys duseni*
1: 1->0
20: 1->0
44: 1->2
85: 1->0
157: 0->1
203: 0->1

Neoplecostomus
14: 1->0
29: 1->0
30: 1->0
78: 0->1
96: 1->0
116: 0->1
126: 1->0
128: 0->1
151: 0->1
173: 0->1
175: 2->1
183: 1->0
187: 1->0
188: 1->0

Isbrueckerichthys
4: 0->1
23: 1->0
45: 0->1
53: 2->1
83: 0->2
196: 2->3

below *Hypoptopoma* sp. - *Kronichthys* sp.
27: 1->2
53: 2->1
168: 1->0

Hypoptopomatinae
1: 1->0
14: 1->0
103: 0->1
109: 0->2
131: 0->1
154: 0->1
161: 0->1
162: 1->0
163: 1->0
195: 1->0
203: 0->1

below *Hypoptopoma* sp. - *Parotocinclus britskii*
15: 0->1
95: 0->1
97: 2->1
141: 1->0
154: 1->2
156: 1->0
160: 1->0
172: 1->0

below *Hypoptopoma* sp. - *Hisonotus* sp.
43: 0->1
87: 0->1
202: 0->1

below *Hypoptopoma* sp. - *Otocinclus vittatus*
44: 1->0
57: 2->0
98: 1->0
105: 1->2
110: 1->0

below *Hypoptopoma* sp. - *Nannoptopoma spectabila*
54: 0->1
88: 1->0
131: 1->0
141: 0->1

Otocinclus
11: 0->1
14: 0->1
51: 1->0
52: 2->0
53: 1->0
62: 0->2
64: 1->2
97: 1->0
128: 0->1
148: 1->0
156: 0->1
159: 0->1
172: 0->1
210: 0->1
212: 0->1

Loricariinae
1: 1->0
27: 1->0
28: 0->1
92: 0->1
121: 1->0
124: 0->1
127: 0->1
144: 0->1
145: 1->0
163: 1->0
191: 1->0
195: 1->0

below *Crossoloricaria venezuelae* - *Rineloricaria rupestris*
7: 1->0
8: 1->0
14: 1->2
17: 1->0
30: 1->0
50: 0->1
53: 2->0
60: 0->1
69: 0->1
72: 0->1
108: 0->1
155: 0->1
189: 0->1

below *Crossoloricaria venezuelae* - *Loricariichthys brunneus*
22: 0->1
55: 0->1
74: 1->0
83: 0->1
106: 0->1
141: 0->1
153: 0->1

below *Crossoloricaria venezuelae* - *Loricaria cataphracta*
11: 0->1
12: 0->1
13: 0->1
18: 1->0
44: 1->0
88: 1->2
135: 0->1
164: 1->0
167: 1->0
168: 1->0
179: 0->1
197: 2->1
206: 0->1

Crossoloricaria
4: 0->1
103: 0->1
129: 0->2
163: 0->1

below *Ixinandria montelbelloi* - *Rineloricaria rupestris*
23: 0->1
52: 2->0
110: 1->0
183: 0->1
188: 0->1

below *Harttia* sp. - *Sturisomatichthys citrensis*
11: 0->1
98: 1->0

below *Harttia* sp. - *Lamontichthys llanero*
14: 1->0
81: 0->1
97: 2->1
103: 0->1
134: 0->1
197: 2->1

below *Sturisoma festivum* - *Sturisomatichthys citrensis*
26: 1->2
43: 0->1
85: 0->1
104: 0->1
132: 0->1
141: 0->1
173: 0->1
183: 0->1
188: 0->1

Hypostomiane
7: 1->2
83: 0->1
97: 2->1
123: 0->1
148: 1->0
173: 0->1

Corymbophanini
15: 0->1
16: 0->1
30: 1->0
46: 0->1
58: 0->1
62: 0->1
63: 0->1
85: 0->1
100: 2->1
138: 1->0
192: 0->1

below *Pogonopoma wertheimeri* - New Genus 3
8: 1->2
88: 1->2
94: 0->1
98: 1->0
122: 1->0
160: 1->0
196: 2->3
197: 2->1

Rhinelepini
31: 0->1
59: 0->1
105: 1->2
106: 0->1
129: 0->1
162: 1->0

210: 0->1
211: 0->1

below *Pogonopoma wertheimeri* - *Rhinelepis aspera*
25: 0->1
61: 0->1
62: 0->1
99: 0->1
194: 0->1
211: 1->2

Pogonopoma
54: 0->1
57: 2->1
73: 0->1
74: 1->0
122: 0->1
131: 0->1
156: 0->1
167: 1->2
174: 0->1
211: 2->3

below *Hypostomus ammophilus* - New Genus 3
33: 0->1
81: 0->1
111: 0->1
119: 0->1
137: 1->0
150: 1->2
184: 0->1
190: 0->1

Hypostomini
78: 0->1
112: 0->1
156: 0->1

below *Hypostomus ammophilus – H. villarsi*
178: 0->1
199: 0->1

below *Hypostomus ammophilus – H. emarginatus*
16: 0->1
92: 0->1
132: 0->1
133: 0->1

below *Hypostomus ammophilus – H. unicolor*
4: 0->1
8: 2->1
24: 0->1
26: 2->0
27: 1->2
90: 1->2
111: 1->0
120: 1->0
179: 0->1
204: 0->1

below *Hypostomus cochliodon – H. bolivianus*
NUC

below *Hypostomus cochliodon* - *Hypostomus cordovae*
NA

below *Hypostomus cochliodon – H. plecostomus*
68: 0->1
158: 1->0

below *Hypostomus cochliodon – H. sculpodon*
46: 0->1
69: 0->1

below *Hypostomus cochliodon – H. plecostomoides*
36: 1->0
70: 0->1
205: 0->1

below *Hypostomus hemicochliodon – H. sculpodon*
11: 0->1

below *Hypostomus roseopunctatus – H. sculpodon*
25: 1->0

below *Hemiancistrus aspidolepis* - New Genus 3
88: 2->3
183: 0->2
184: 1->2

Pterygoplichthyini
81: 1->2
158: 1->0
213: 0->1

Hemiancistrus annectens group
74: 1->0
112: 0->1

below *Hemiancistrus holostictus* - *Hemiancistrus maracaiboensis*
133: 0->1

Pterygoplichthys
26: 2->0
27: 1->2
121: 1->2
142: 0->1

below *Pterygoplichthys multiradiatus – P. punctatus*
91: 1->2
162: 1->0

below *Pterygoplichthys multiradiatus – P. zuliaensis*
3: 1->2
105: 1->2

below *Pterygoplichthys multiradiatus – P. pardalis*
183: 2->0

below *Pterygoplichthys gibbiceps – P. lituratus*
74: 1->0
118: 0->1

Ancistrini
1: 1->0
16: 0->1
62: 0->1
75: 0->1
85: 0->1
94: 1->0
129: 0->2
167: 1->0

below *Acanthicus hystrix* - *Pseudancistrus sidereus*

61: 0->1
111: 1->2

Panaque clade
44: 1->2
65: 0->1
79: 0->1

below *Acanthicus hystrix* - *Hemiancistrus megalopteryx*
68: 0->1
156: 0->1

below *Acanthicus hystrix* - *Hemiancistrus snethlageae*
42: 0->1
91: 1->2

below *Acanthicus hystrix* - *Hemiancistrus landoni*
65: 1->0
70: 0->1

below *Acanthicus hystrix* - *Hemiancistrus sabaji*
61: 1->0
62: 1->0

below *Acanthicus hystrix* - *Hypancistrus zebra*
29: 0->1
69: 0->1
121: 1->2

below *Acanthicus hystrix* - *Peckoltia caenosa*
101: 0->1
158: 1->0

below *Acanthicus hystrix* - *Peckoltia vittata*
46: 0->1

below *Acanthicus hystrix* - New Genus 1
1: 0->1
10: 1->0
36: 1->0
70: 1->0
158: 0->2
197: 1->2
199: 1->0
205: 0->2

below *Acanthicus hystrix* - *Spectracanthicus* sp.
29: 1->0
79: 1->0
111: 2->1
134: 0->1

below *Acanthicus hystrix* - *Leporacanthicus galaxias*
3: 1->0
8: 2->1
42: 1->0
66: 1->0
74: 1->0
142: 0->1
150: 2->1
188: 0->1

below *Acanthicus hystrix* - *Pseudacanthicus leopardus*
10: 0->1
109: 0->1
135: 0->1

below *Acanthicus hystrix* - *Megalancistrus gigas*
61: 0->1
81: 1->2
107: 0->1
111: 1->2
128: 0->1
130: 0->1
131: 0->1
167: 0->1
197: 2->1
215: 0->1

Spectracanthicus
55: 0->1
58: 0->1
91: 2->1
98: 0->1
143: 0->1

below *Panaque albomaculatus* - *Peckoltia vittata*
94: 0->1

below *Panaque albomaculatus* - *Peckoltia furcata*
3: 1->0
121: 2->1

below *Panaque albomaculatus* - *Panaque aureatus*
36: 1->0
62: 0->1
67: 0->1
99: 0->1
112: 0->1

Panaque
97: 1->2
117: 0->1

Panaque (*Panaqolus*)
3: 0->1
53: 2->1
136: 0->1

below *Panaque albomaculatus* - *Panaque changae*
132: 1->0

below *Parancistrus auarantiacus* - *Peckoltia caenosa*
57: 2->1
116: 0->1

Hypancistrus
16: 1->0
49: 0->1
51: 1->0
52: 2->1
53: 2->0
64: 1->0

below *Hypancistrus contradens* - *Hypancistrus furunculus*
36: 1->0
57: 2->1

below *Hemiancistrus micromattos* - *Hemiancistrus snethlageae*
121: 1->2

Baryancistrus
121: 1->2
143: 0->1

below *Baryancistrus demantoides – B. niveatus*
91: 1->2
112: 0->1
120: 1->0

Ancistrus clade
98: 0->1
134: 0->1
150: 2->1
158: 1->2
160: 0->1
203: 1->0

below *Ancistrus pirareta* - *Dekeyseria scaphirhyncha*
39: 0->1
42: 0->1
75: 1->2
76: 0->1
188: 0->1
196: 3->2
208: 0->1
209: 0->1

below *Ancistrus pirareta* - *Neblinichthys yaravi*
32: 0->1

below *Ancistrus pirareta* - *Hopliancistrus tricornis*
40: 0->1
77: 0/1->2

below *Ancistrus pirareta* - *Pseudolithoxus dumus*
48: 0->1
81: 1->2
156: 0->1
160: 1->0

below *Ancistrus pirareta* - *Lasiancistrus tentaculatus*
29: 0->1
64: 1->0
197: 1->2
209: 1->2

Ancistrus pirareta
88: 3->2
101: 0->1
105: 1->2
150: 1->2
188: 1->0
201: 1->0
208: 1->3

Lasiancistrus
5: 0->1
89: 0->1
98: 1->0
114: 0->1
117: 0->1
186: 0->1

below *Lasiancistrus guacharote* - *Lasiancistrus tentaculatus*
11: 0->1
121: 1->2
128: 0->1

Pseudolithoxus
11: 0->1
115: 0->1
120: 1->0

below *Chaetostoma anomala* - *Hoplianciстrus tricornis*
119: 1->0
135: 0->1
167: 0->1

below *Chaetostoma anomala* - New Genus 2
88: 3->2
164: 1->0
188: 1->0
208: 1->0

below *Chaetostoma anomala* - *Lithoxus bovallii*
10: 1->0
77: 2->1
97: 1->2
116: 0->1
197: 1->2
209: 1->0

below *Chaetostoma anomala* - *Cordylancistrus torbesensis*
3: 1->0
6: 0->1
27: 1->0
32: 1->0
38: 0->1
40: 1->0
84: 0->1
121: 1->2
142: 0->1
149: 0->1
177: 0->1
196: 2->3

below *Chaetostoma anomala* - *Leptoancistrus canensis*
2: 0->1
21: 0->1
55: 0->1

below *Chaetostoma anomala* - *Cordylancistrus platycephalus*
64: 1->2
180: 0->1

Chaetostoma
10: 0->1
15: 0->1
34: 1->0
42: 1->0
111: 1->0
116: 1->0
135: 1->0

below *Chaetostoma sovichthys* - *Chaetostoma stannii*
77: 1->0
121: 2->1

below *Dolichancistrus cobrensis* - *Leptoancistrus canensis*
157: 0->1
185: 0->1
188: 0->1

below *Dolichancistrus cobrensis* - *Dolichancistrus pediculatus*
10: 0->1
122: 0->1

125: 0->1
166: 0->1
177: 1->0

below *Exastilithoxus fimbriatus* - *Lithoxus bovallii*
7: 2->1
8: 2->1
14: 1->0
17: 1->0
23: 0->1
30: 1->0
41: 0->1
48: 0->1
52: 2->1
57: 2->1
68: 0->1
69: 0->1
71: 0->1
100: 2->1
122: 0->1
125: 0->1
157: 0->1
167: 1->0
173: 1->0
205: 0->2

Exastilithoxus
42: 1->0
65: 1->0
81: 1->0
100: 1->0
168: 1->0
171: 1->0
207: 0->1

Lithoxus
3: 1->2
44: 2->1
47: 0->1
58: 0->2
93: 1->0
128: 0->1
153: 0->1
155: 0->1
210: 0->1
214: 0->1

Neblinichthys
1: 0->1
37: 0->1
46: 0->1
128: 0->1
197: 1->2
199: 0->1
200: 0->1

Dekeyseria
26: 2->0
125: 0->1
155: 0->1
156: 0->1
198: 0->1

Pseudancistrus
34: 1->0
35: 0->1
58: 0->1
105: 1->0
117: 0->1
172: 0->1

below *Pseudancistrus* sp. – *P. megacephalus*
21: 0->1
121: 1->2

below *Pseudancistrus* sp. – *P. brevispinnis*
46: 0->1
97: 1->2

below *Pseudancistrus* sp. – *P. pectegenitor*
61: 1->0
62: 1->0
128: 0->1
188: 0->1
208: 0->1

below *Pseudancistrus* sp. – *P. barbatus*
1: 0->1
184: 2->1

below *Pseudancistrus orinoco* – *P. pectegenitor*
180: 0->1
197: 1->2
209: 0->1

below *Pseudancistrus orinoco* – *P. yekuana*
81: 1->0
135: 0->1
164: 1->0

Delturinae
23: 0->1
27: 1->0
28: 0->1
64: 1->2
66: 0->1
73: 0->1
81: 0->1
115: 0->1
128: 0->1
147: 0->1
167: 0->2
170: 0->1
183: 0->1
188: 0->1
192: 0->1
196: 2->3